

# MUELLERIA



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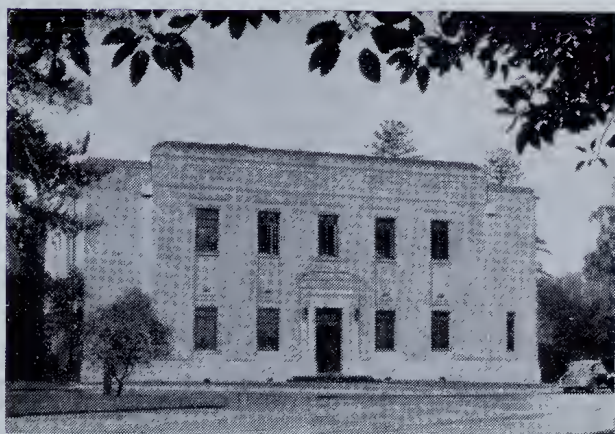
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ROYAL BOTANIC GARDENS, MELBOURNE

VICTORIA, AUSTRALIA

R. T. M. PEScott, Director and Government Botanist

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# THE GENUS *VILLARSIA* (MENYANTHACEAE) IN AUSTRALIA

by

HELEN I. ASTON\*

## SUMMARY

The species of *Villarsia* Vent. found within Australia are described and the distinctions and distribution of each given. Stress is laid on the taxonomic importance of seeds within the genus. The correct application of the name *V. exaltata* (Soland. ex Sims) G. Don is explained and this species is shown to be quite distinct from *V. reniformis* R. Br. with which it has long been erroneously synonymised. Two new species and one new variety are described for the first time—these are *V. submersa*, *V. umbricola* var. *umbricola*, and *V. umbricola* var. *beagleholei*.

The genus within Australia is seen to consist of 9 species endemic to south-western Australia, and 3 species and one variety endemic to eastern Australia. It is also possible that some species now placed under *Nymphoides* Hill may prove to be better placed under *Villarsia* Vent.

## INTRODUCTION

*Villarsia* Ventenat, Choix Plant. 9 (1803) has been conserved against *Villarsia* J. F. Gmelin, Syst. Nat. 2: 306, 447 (1791). The type species is *V. ovata* (L.f.) Vent., now correctly known as *V. capensis* (Houtt.) Merrill (Merrill 1938, p. 360). Although this type species is South African, and the only South African species of *Villarsia*, the genus is chiefly an Australian one. Apart from perhaps three species found in Cambodia, Laos, and the Malayan Peninsula, all others are confined to south-western and south-eastern Australia. N. T. Burbidge (1963) gives 9 endemic species for this country but the results of the present work increase this number to 12 species plus one good variety.

In most older works and in State floras *Villarsia* has been placed in the family Gentianaceae, and, where the family has been subdivided, in the tribe Menyantheae. Hutchinson (1960, p. 451) removes the Menyantheae from Gentianaceae and gives it family status as Menyanthaceae. The Menyanthaceae are characterised by alternate leaves and valvate or induplicate-valvate corolla-lobes, while opposite leaves and contorted or rarely imbricate corolla-lobes are shown by the Gentianaceae. This distinction has gained acceptance, and *Villarsia* is placed in the Menyanthaceae in the recent floras of Eichler (1965, p. 260) and Beadle, Evans, and Carolin (1962, p. 353).

In early literature there has been confusion between the generic names *Villarsia*, *Swertia*, *Liparophyllum*, *Limnanthemum* and *Nymphoides*, and distinctions between these have not always been clear or agreed upon. Within Australia *Nymphoides* Hill (syn. *Limnanthemum* S. G. Gmel.) is the only genus containing species which might be confused

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\* National Herbarium of Victoria.

with *Villarsia*. Typically *Nymphoides* can be distinguished by its aquatic habit, its non-paniculate inflorescence with the pedicels arising from a short, weak peduncle (or the peduncle absent so that the pedicels appear in a cluster) which is often subtended by one or a cluster of several sessile or near-sessile and floating leaves, and also by its non-valvate, indehiscent or irregularly breaking fruits. *Villarsia* spp., by contrast, although frequently aquatic are best considered as wetland plants, and most typically have erect, paniculate inflorescences and valved, capsular, dehiscent fruits. *Nymphoides* has generally been retained to date for our northern and north-eastern tropical and semi-tropical species, including 2 well-known ones which penetrate into south-eastern Australia, but the distinctions between the two genera are not always clear to the present writer, and the fruiting characters in particular show variation. From material seen it appears possible that at a later date a few species now placed under *Nymphoides* may be more correctly transferred to the genus *Villarsia*. It seems unwise to take any action in this direction at present without adequate coverage of specimens and without field experience of the family in northern and north-eastern areas of Australia. It is obvious from collections housed at the National Herbarium of Victoria that the genus *Nymphoides* itself is also in need of revision.

Australian species which have at some time been considered under *Villarsia* but which are now placed under *Nymphoides* are not mentioned in this paper.

#### METHOD OF WORKING

Results shown in the present paper have been obtained from a personal study of all *Villarsia* specimens housed in the Australian state herbaria and several others, together with extensive field observations in Victoria and South Australia. Where necessary photographs or seeds of type material were obtained from overseas herbaria for direct comparison here, or else selected specimens were forwarded overseas for comparison with types and critical comment. For most species however, syntype material was available in the collections of the state herbaria and in these cases where typification was clear no further efforts were made to locate other existing types. Because all type material will not have been located or seen by the writer, lectotypes have generally not been chosen.

The field work undertaken in Victoria and South Australia was most essential, and in fact the full study originated from the writer's discovery of two distinct species of *Villarsia* growing side by side in a swamp near Cranbourne and thus belying the accepted understanding that only one species existed in the State. The field provided many measurements and observations not obtainable from Herbarium specimens, particularly regarding the habit, flower span, other floral characters, maximum variations of size, and distribution. Representative collections were made in all areas visited, and additional locality records were kept.

All species (and variety) from eastern Australia have been examined in the field, but all those from western Australia are known to me only from herbarium material. This necessarily means that the range of



measurements given will not be as broad for western species, as only comparatively meagre material is available and whole populations have not been seen. Floral characters in this genus are impossible to ascertain from herbarium specimens as the flowers are very fugitive and deliquescent. Those given for western species have therefore been taken from collector's notes or early descriptions. Similarly plant height and habitat has mostly been ascertained from specimen labels or from prior descriptions.

### DIAGNOSTIC CHARACTERS

**Habit.**—The size, and erect, reclining, robust, slender, herbaceous, or stoloniferous habit of plants, and the erect or floating foliage, can be very useful where plants appear typical under good growing conditions for the particular species concerned.

**Foliage.**—Leaf size, ratio of length to breadth, outline, shape of the base, margin, texture, matt or glossy surfacing, degree of dorsiventrality, and prominence of venation can be diagnostic in themselves, but are not always so and must then be used in conjunction with other characters.

**Inflorescence.**—*V. capitata* and *V. congestiflora* are immediately distinguished from other species by their sessile flowers in clusters or heads. Amongst the remaining species, the degree of openness or compactness of the panicle, of slenderness and length of the pedicels, and whether the pedicels of mature capsules are erect or reclining are of some use.

**Flowers.**—The strongly heterostylous character (Fig. 27) of *V. exaltata* contrasts with the homostyly of other species. It is possible that *V. parnassifolia* also shows heterostyly, but this requires field checking.

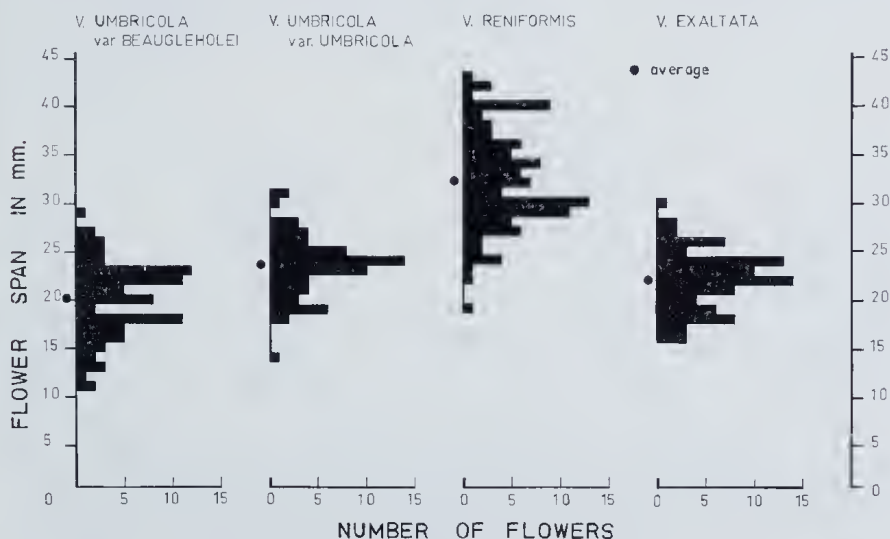


Fig. 1.—Variation in the corolla span of eastern species of *Villarsia*.

**Calyx.**—This may consist of lobes which are virtually free from the base or attached only in the very basal region, or which spring from the summit of a pronounced calyx-tube. The tube may be relatively inconspicuous in flower but may enlarge as the capsule matures, and remains adnate to the lower portion of the capsule wall. This explains

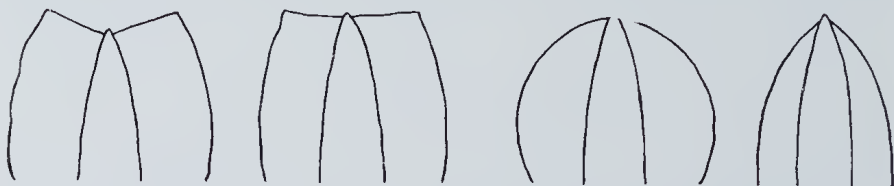


Fig. 2—Variation in the corolla-lobe apex of *V. exaltata*, *V. reniformis*, and *V. umbricola*. All shapes may be found within the one population.

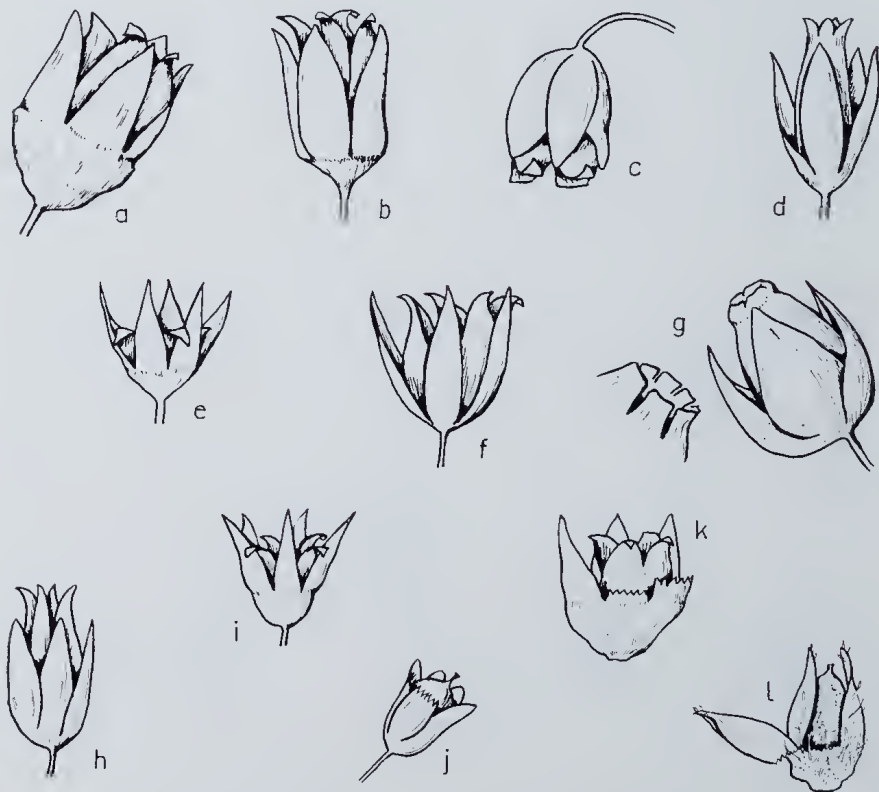


Fig. 3—Capsules of *Villarsia* spp., all approx.  $\times 2$ , contained within the persistent calyces. a, *V. exaltata*, Aston 1577. b, *V. reniformis*, Aston 1583. c, *V. umbricola*, MEL16407. d, *V. parnassifolia*, J. W. Green 868. e, *V. latifolia* MEL16452. f, *V. lasiosperma*, MEL877. g, *V. calthifolia*, J. Hale, Dec. 1939. h, *V. albiflora*, MEL16437. i, *V. violifolia*, MEL16485. j, *V. submersa*, R. D. Royce 3778. k, *V. congestiflora*, MEL16482. l, *V. capitata*, R. D. Royce 5174.



why the length of mature capsules may be greater than that of the calyx-lobes yet the capsule may still not project beyond the lobe tips and may be said to be shorter than them. Width of the calyx-lobes is not always helpful but these are broad in *V. calthifolia* and slender in *V. latifolia* and *V. lasiosperma*. The membranous lobe margins of the latter species are more conspicuous than those of other *Villarsia* species.

**Corolla.**—Corolla size (Fig. 1) is important in eastern species, but has not been examinable for those of the west. The span is measured from the tip of one corolla-lobe diametrically across the centre of the corolla while pressing the lobes outwards horizontally from their points of connection at the insertion of the anthers. Corolla colour is constantly

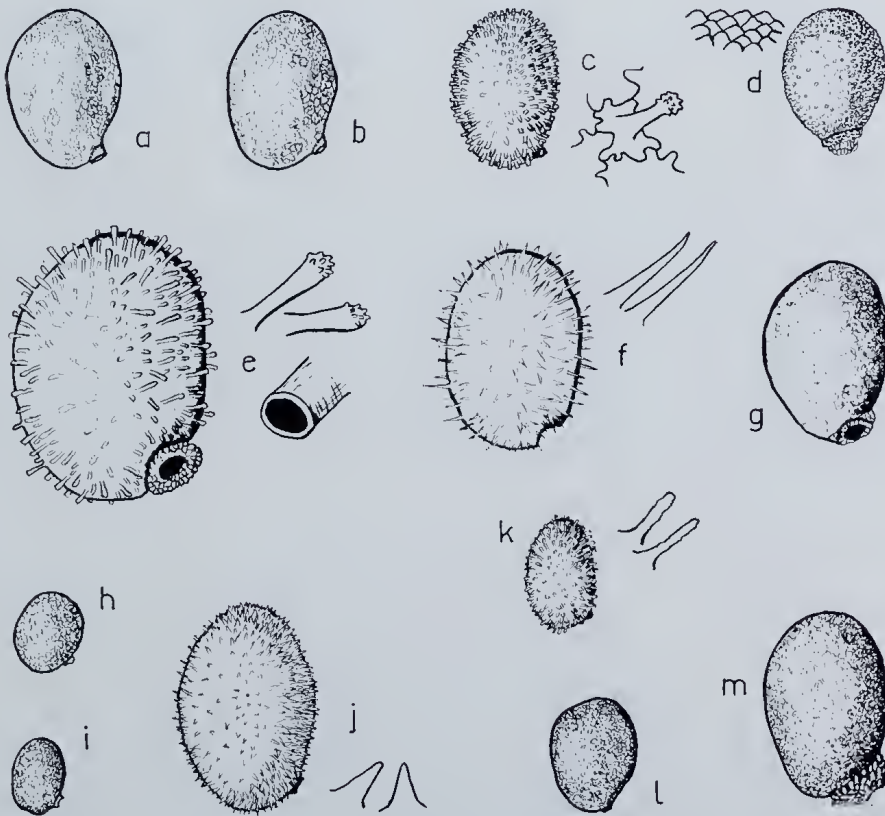


Fig. 4—Seeds of *Villarsia* spp., x 15, with enlargements of surface projections. a, *V. reniformis*, Aston 1434. b, *V. umbricola* var. *umbricola*, Aston 1531. c, *V. umbricola* var. *beaugholelei*, Aston 1445. d, *V. congestiflora*, MEL874. e, *V. exaltata*, Aston 1432. f, *V. lasiosperma*, MEL16493. g, *V. violifolia*, MEL16491. h, *V. parnassifolia*, MEL16384. i, *V. submersa*, R. D. Royce 3778. j, *V. calthifolia*, MEL16478. k, *V. albiflora*, MEL16443. l, *V. capitata*, R. D. Royce 2237. m, *V. latifolia*, MEL16456.

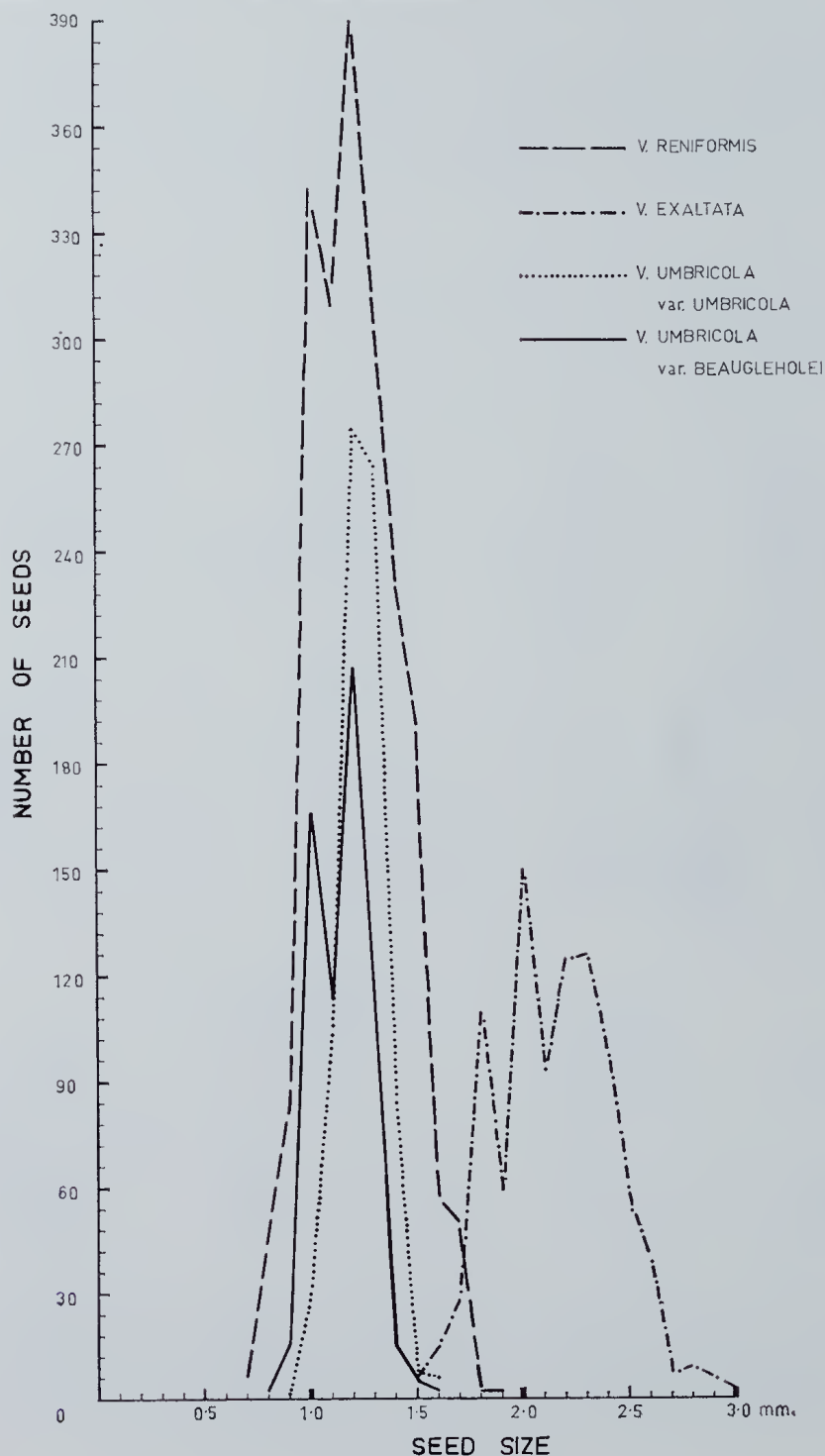


Fig. 5—Graph of seed size in eastern species of *Villarsia*.

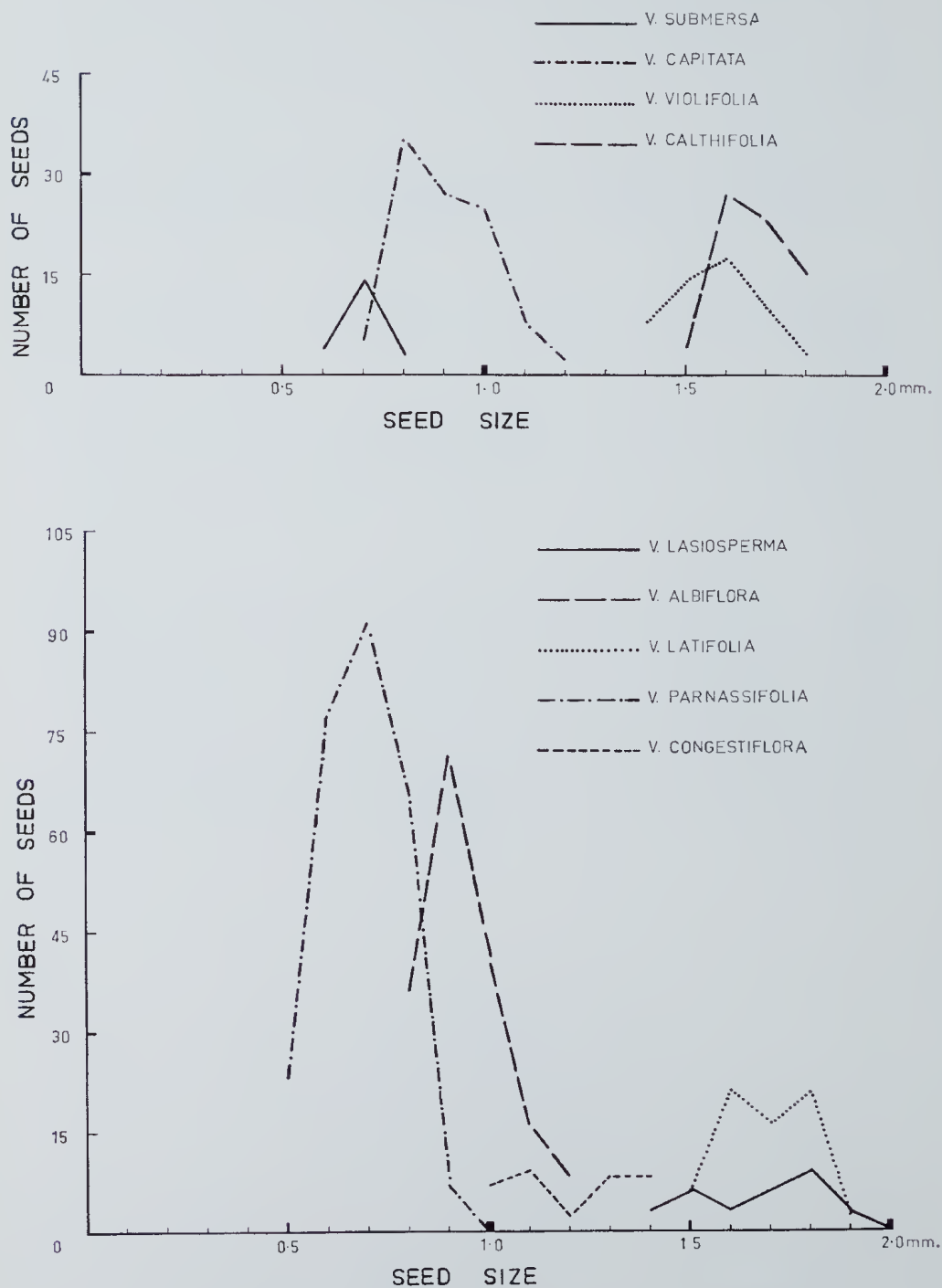


Fig. 6—Graph of seed size in western species of *Villarsia*.

white or yellow for each species. The presence of a longitudinal keel or wing on the inner surface of each corolla-lobe is peculiar to *V. lasiosperma*.

The shape of the corolla lobes (Fig. 2) in all eastern species is quite variable and of no diagnostic value. The lobe apex may alter from acute to obtuse to truncate to emarginate even within the one population.

**Ovules.**—The number of ovules per placenta has not been well-investigated, but it appears that this character would have very little diagnostic significance.

**Capsule.**—The shape, mode of dehiscence, thickness of the wall, degree of adherence to the calyx-tube, and length in comparison with the calyx are all useful features (Fig. 3). Measurements refer to the ripe, open capsule.

**Seed.**—Seeds (Fig. 4) are of primary importance diagnostically. Size (Figs. 5, 6), shape, surface patterning, presence or absence of tubercles, types of tubercles, and presence or absence of a conspicuous caruncle are all valuable features. The term “jig-saw” (Fig. 7) has been coined as most appropriate for the surface patterning wherein each minute segment sends projections into those alongside as with the pieces of a jig-saw puzzle. The segments are usually distinctly outlined, but at times appear less-defined and resemble hills and spurs separated by reticulating gullies. Length was measured across the widest diameter of each seed, this usually commencing somewhat away from the point of attachment.

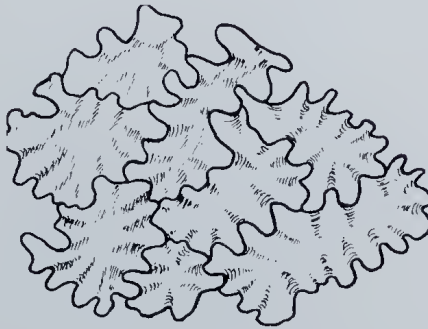


Fig. 7—Diagram of the “jig-saw” surface pattern of seeds of some *Villarsia* spp.

## CITATION OF SPECIMENS

Except for several inadequate specimens all those examined in the herbarium are cited under their specific descriptions. For the sake of brevity, localities have often not been given in complete detail. For collections made by myself only the sheets retained at MEL are listed (except for types), but it is to be understood that all duplicates forwarded to other herbaria have also been examined. Herbarium abbreviations used are:—

AD—State Herbarium of South Australia, Adelaide; ADW—Waite Agricultural Research Institute, Adelaide; BM—British Museum (Natural History), London; BRI—Botanic Museum and Herbarium, Brisbane; CANB—Division of Plant Industry, C.S.I.R.O., Canberra; CANBLR—Land Research and Regional Survey, C.S.I.R.O., Canberra; CBG—Canberra Botanic Gardens, Canberra; FI—Herbarium Universitatis Florentinae, Florence; HO—Botany Department, University of Tasmania, Hobart; K—Royal Botanic Gardens, Kew, England; L—Rijksherbarium, Leiden, Holland; MEL—National Herbarium of Victoria, Melbourne; MELU—Botany Department, University of Melbourne; NSW—National Herbarium of New South Wales, Sydney; PERTH—Western Australian Herbarium, Perth; PERTHU—Botany Department, University of Western Australia, Perth; SYD—Department of Botany, University of Sydney.

The symbol (Sd) placed before a collection indicates the presence of seed.

KEY TO THE AUSTRALIAN SPECIES OF *VILLARSIA*

1. Flowers sessile or near-sessile in few-flowered clusters or in dense heads, corolla yellow. Western species.
2. Calyx-tube and sometimes also the calyx-lobes covered sparsely or densely with long fine hairs, capsule thinly membranous, apparently breaking or dehiscing irregularly, seed smooth and shining, non-carunculate. . . . . 1. *V. capitata*
2. Calyx glabrous, capsule thickly chartaceous, splitting into 4 recurved valves, seed strongly granular and dull, noticeably carunculate . . . . . 2. *V. congestiflora*

1. Flowers occurring singly on pedicels 4–70 mm. long in open panicles, corolla yellow or white. Western or eastern species.
  3. Corolla white. Western species.
    4. Extremely slender, fine-branched, totally submerged aquatic; radical leaves  $\pm$  elliptic, to 6 cm. long, twice to three times as long as broad, dorsiventral; each corolla lobe without a longitudinal keel on the inner surface; seed small, 0.6–0.8 mm. long, smooth.....3. *V. submersa*
    4. Erect, tufted, reasonably stout, emergent plants with culms to 3(–5) feet high.
      5. Radical leaves lanceolate to ovate, non-cordate, to 9.5 cm. long,  $\pm$  twice as long as broad, thick-textured to semi-succulent, not markedly dorsi-ventral, both surfaces matt (or the upper ? sometimes somewhat glossy); each corolla lobe with a longitudinal keel on the inner surface; seed large, 1.4–2 mm. long, the surface with moderately-dense, fine, tapered, spinescent tubercles to 0.2 mm. long.....4. *V. lasiosperma*
      5. Radical leaves  $\pm$  sub-orbicular, cordate, to 7 cm. long, slightly broader than long or dimensions about equal, strongly dorsiventral, upper surface  $\pm$  glossy-green, lower surface paler and dotted; each corolla lobe without a longitudinal keel on the inner surface; seed medium, 0.8–1.2 mm. long, densely covered in short, rigid, hollow tubercles ca. 0.5 mm. long (or rarely these reduced to granules).....5. *V. albiflora*
  3. Corolla yellow. Western or eastern species.
    6. Small, low, stoloniferous, mat-forming perennial with slender culms to 15 cm. high; radical leaves small, to 3 cm. long, thin-textured; capsule not circumscissile, opening from the apex in 4 acute valves; seed 1.4–1.8 mm. long, smooth, glossy or matt, with a conspicuous, almost-basal, translucent caruncle. Western species.....6. *V. violifolia*
    6. Large, erect, robust, non-stoloniferous perennial, with culms to 7–8 feet high; radical leaves large, to 20 (?–30) cm. long and broad, almost round, deeply cordate, the margin strongly and irregularly toothed, the teeth callose-tipped; capsule circumscissile near the apex, then opening by an apical pore or splitting into truncate-tipped valves; seed 1.5–1.8 mm. long, densely covered with short, hollow, tapered tubercles, without a conspicuous caruncle. Western species.....7. *V. calthifolia*
    6. Medium to large, erect or semi-erect, tufted perennials. Western or eastern species.



## 7. Western species.

8. Radical leaves thin-textured,  $\pm$  glossy, the veins prominent beneath, edges crenate-dentate; capsule 2–5 mm. long, shorter than the calyx, the lower  $\frac{1}{4}$ – $\frac{1}{3}$  adnate to it, globose or sub-globose, thick-walled, opening by 4 distinct, recurved valves; seed large, 1.5–1.9 mm. long, smooth and usually glossy, with a prominent,  $\pm$  circular, translucent caruncle.....8. *V. latifolia*
8. Radical leaves thick-textured, apparently semi-succulent, matt-surfaced, the veins rather inconspicuous, edges sub-entire to crenate-dentate; capsule 4–10 mm. long, usually 1–2 mm. longer than the calyx and adnate to it only at the base, narrow-lanceolate to narrow-ovate in outline and usually appearing slender, thin-walled, opening by valves only near the apex; seed small, 0.5–1 mm. long, faintly granular, without a conspicuous caruncle.....9. *V. parnassifolia*

## 7. Eastern species.

9. Radical leaves erect, ovate-elliptic to broad-ovate, usually much longer than broad, base rounded to only shallowly cordate, thick-textured, matt and  $\pm$  uniform on both surfaces; flowers heterostylous; capsule with the lower  $\frac{1}{3}$  to  $\frac{1}{2}$  adnate to the calyx-tube; seed large, (1.5–) 1.7–2.6 (–3) mm. long, light cream-fawn to dark brown-grey-black, mostly sparsely to densely tuberculate (tubercles to 0.3 mm. long), conspicuously carunculate.....10. *V. exaltata*
9. Radical leaves erect or floating, ovate to reniform, mostly about as broad as long or either dimension somewhat greater than the other, base usually slightly to deeply cordate, matt-surfaced to glossy above, often strongly dorsiventral; flowers homostylous; capsule adnate to the calyx-tube only at the very base; seed smaller, (0.7–) 1–1.5 (–1.9) mm. long, pale never blackish, smooth to slightly granular (but tuberculate in *V. umbricola* var. *beaugleholei* q.v.), without a conspicuous caruncle.
10. Plants stoloniferous when in water, radical leaves then floating flat, strongly dorsiventral, glossy and deep green above, pale and red-dotted beneath; culms  $\pm$  erect and self-supporting; inflorescence chiefly terminal on the culm; flower span 19–43 (average 32.3) mm.; mature capsules on erect pedicels.....11. *V. reniformis*

10. Plants non-stoloniferous; radical leaves on plants in water either erect or floating, but then not lying fully flat, surfaces not strongly dorsiventral, somewhat yellowish-green; culms slender, weak, semi-erect or reclining against supports; inflorescence lax and spreading from much of the culm; flower span 11–31 (average 21.7) mm.; mature capsules on recurved pedicels.

11. Seeds almost smooth to granular.....  
.....12. *V. umbricola* var. *umbricola*

11. Seeds densely tuberculate, the tubercles to 0.75 mm. long.....12. *V. umbricola* var. *beaugleholei*

#### TAXONOMIC TREATMENT

**Villarsia** Vent. Choix Plant. 9 (1803) nom. cons.

Type species not examined.

Aquatic or damp-land, glabrous, tufted, small to tall and robust, sometimes stoloniferous, perennial or annual herbs. *Roots* fibrous, the perennial species also mostly having a thickened, branched, compact rootstock. *Radical leaves* well-developed, erect or floating, on petioles winged and semi-sheathing towards the base, the blades simple, from mildly to strongly dorsiventral and often dotted beneath, variously elliptic, ovate, rotund, or reniform, from rounded to very strongly cordate at the base, with margins entire to crenate-dentate, texture thin to thick and semi-succulent. *Culms* 1-several, erect or semi-reclining, from a few centimetres to 5 feet (or more) high, bearing mostly an open, paniculate inflorescence, or sometimes the flowers in clusters or heads; cauline leaves sometimes absent and represented by bracts only, but mostly the lower 1-few panicle branches are subtended by petiolate, radical-like leaves with those of the higher branches progressively reducing to form narrower, sessile, semi-clasping bracts, the final bracts subtending each panicle branch or pedicel being 0.5 cm. or less long, elliptic and stem-clasping. *Flowers* homo- or hetero-stylous, mostly well-pedicellate, sometimes sessile in clusters or heads. *Calyx* persistent, 5-lobed, the lobes mostly distinct almost to the base in flower, and remaining so in fruit or the calyx-tube then enlarging to equal perhaps half the length of the fruiting calyx. *Corolla* yellow or white, very deliquescent, opening for 1 day only, conspicuously fimbriate at the throat, up to 4 cm. in diameter, gamopetalous, 5- (sometimes 4- or 6-) lobed, the lobes spreading, each with broad margins and sometimes with a longitudinal, vertical keel on the inner surface, induplicate-valvate in bud, the tube broad and approximately one third the corolla length (at least in eastern species). *Ovary* superior to semi-inferior,

unilocular with 2 (abnormally 3) parietal placentas, surrounded by 5 small, often orange, nectary glands at the base; style single, terminal; stigmas 2 (abnormally 3), flattened, papillate, exserted. *Filaments* exceedingly short or almost lacking, inserted on the corolla tube at the junction of the lobes; anthers 2-celled, linear or linear-lanceolate, yellow (at least in eastern species), opening introrsely. *Fruit* a few- to many-seeded capsule splitting at the summit into 4 (or secondarily more) somewhat recurved valves, or sometimes breaking irregularly; capsule adnate below to the calyx-tube. *Seeds* smooth to tuberculate according to species.

1. *Villarsia capitata* Nees in Lehm. *Plant. Preiss.* 1 : 365 (1845).

*V. involucrata* Hook. *Icon. Plant.* t.725 (1848).

Rather small, erect, tufted, non-stoloniferous plant, with flowers clustered in dense heads. Apparently annual. *Radical leaves* erect, on petioles 3–11 (–20) cm. long; blades from < 1–4 cm. broad and long, almost rotund to reniform, usually broader than long, apex obtuse or mostly rounded, base truncate to cordate with the sinus broad and shallow to narrow and deep (ca.  $\frac{1}{3}$  length of blade), edge entire to crenate or crenate-dentate, texture thin, under surface sometimes dotted. *Culms* several, erect, 7–29 cm. high, branching dichotomously from low down; cauline leaves radical-like at the lower 1–4 nodes, on petioles to 5–6 cm. long, becoming more obtuse at the base of the blade and bract-like higher on the culm, the upper petioles short and sometimes broadly-winged, final bracts sessile. *Inflorescence* a dense, compact head of sessile flowers subtended by 2 broad, sessile, leafy, involucre bracts, or the bracts not always developed; heads 1–1.5 (–2) cm. wide, terminal on the main culm branch and short side branches, appearing sparsely or densely woolly from the hairs of the calyx; involucre bracts and peduncles glabrous to villous. *Flowers* homostylous; calyx-lobes 3 (–5) mm. long, narrow-to-broad-lanceolate; calyx-tube covered sparsely or densely with long fine hairs, these sometimes arising also from the outside of the calyx-lobes; corolla yellow, described by Nees as shorter than the calyx, without longitudinal keels on the lobes. *Capsule* small, ellipsoid, shorter than to almost equal to the calyx, the lower  $\frac{1}{4}$ – $\frac{1}{2}$  adnate to the calyx-tube, thinly membranous, apparently irregularly breaking or dehiscent. *Seed* small, (0.7–) 0.8–1.1 (–1.2) mm. long, straw-yellow through brown to finally black, broad elliptic, double-convex, smooth and shining, with very fine, reticulated ridging and pitting, without a conspicuous caruncle.



Fig. 8—*V. capitata*, shape of radical leaves,  $\times \frac{2}{3}$ . a, A. Morrison, 4.12.1900. b, C. A. Gardner, 27.9.1944. c, E. Salisbury, Aug 1949. d, e, MEL16474.

DISTRIBUTION:

South-west Western Australia, in the vicinity of the Greenough and Irwin Rivers, and from Perth to Albany.

HABITAT:

Swampy soils. Recorded on sand and clay.

FLOWERING TIME:

Fl. and Fr. recorded Aug.-Dec.

TYPIFICATION:

The following syntypes have been seen—(Sd) Preiss No. 1956 (MEL16470-1 and NSW 90572), syntype of *V. capitata*, cited by Nees as "In paludosis ad flumen Canning, Perth, Novembri a. 1841. Herb. Preiss. No. 1956"; (Sd) Drummond No. 7 (MEL16468-9), syntype of *V. involucrata*, cited by Hook as "Swan River, Western Australia. James Drummond, n. 7, 1845".

DISCUSSION:

The capitate heads of this species distinguish it from all others in the genus except *V. congestiflora*, with which it could readily be confused at first sight. It differs from that species however in the denser heads, woolly calyx and other inflorescence parts, non-valvate capsule, and smooth, shining, non-carunculate seeds.

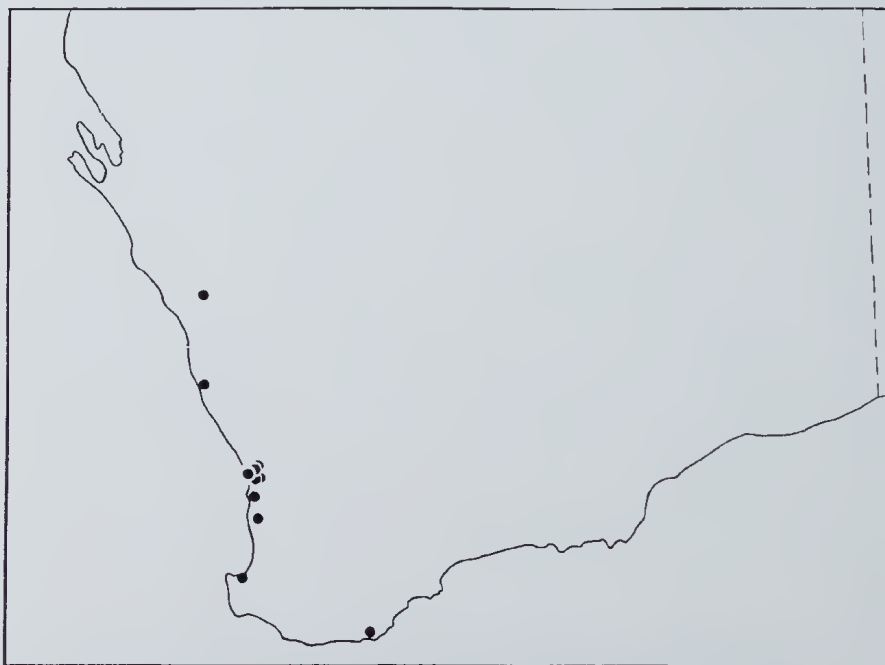


Fig. 9—*V. capitata*, distribution map.

## SPECIMENS EXAMINED (EXCLUDING TYPES):

WESTERN AUSTRALIA—(Sd) W.A., (MEL16473) "wet sand"; (Sd) S.W.Austr., Mr. Clarke (MEL16472); Serpentine R., W.A., Oldfield (MEL16475) "fl. yellow"; King George Sound, J. R. Muir (MEL16474); (Sd) Irwin's and Greenough's River, F. Mueller, Nov. 1877 (MEL21956); Cannington, R. Helms, 12.11.1898 (PERTH, and NSW77138); Midland Junction, Swan River, Alex Morrison, 16.11.1898 (MEL26380; NSW90569) "swamps"; (Sd) Swan district, E. Pritzel, Dec. 1900 (NSW570) "locis subhumidis"; (Sd) Avon district, Byfields Mill, Diels and Pritzel, Dec. 1900 (PERTH); (Sd) Midland Junction, Swan River, Alex Morrison, 4.12.1900 (PERTH); Kelmscott, Canning R., Alex Morrison 10326, 14.12.1900 (PERTH) "Swamp"; W.A., A. G. Hamilton 518, 1902 (NSW90513); (Sd) Busselton, F. Stoward 224, Nov. 1912 (NSW 90571); Perth, Mr. Carlour, 14.11.1917 (PERTH); Busselton, C. A. Gardner, 27.9.1944 (PERTH); (Sd) Coolup, R. D. Royce 2237, 13.10.1947 (PERTH) "Flrs. yellow. Swampy clay soil"; (Sd) W.A., E. Salisbury, Aug. 1949 (PERTH); Lower Hill River, C. A. Gardner 10243, 10.10.1951 (PERTH); (Sd) Busselton, R. D. Royce 5174, 3.11.1955 (PERTH) "Flrs. yellow, capitate, calyx sparsely hairy".

2. ***Villarsia congestiflora*** F. Muell. *Fragm. Phyt. Aust.* 6 : 141 (March 1868).

Rather small, erect, tufted, non-stoloniferous plant, with flowers clustered, a few together or in dense heads. Apparently annual. *Radical leaves* erect, on petioles to 11 cm. long, these sometimes strongly red-dotted; blades 1–4 cm. long and broad, broad-ovate to  $\pm$  rotund to  $\pm$  reniform, sometimes broader than long, apex obtuse to rounded, base truncate to cordate, edge entire to crenate or toothed, texture thin, under surface sometimes strongly red-dotted. *Culms* few to several, erect, 10–40 cm. high, sometimes strongly red-dotted in basal regions, branching from near the base; cauline leaves 2–4 radical-like, the lower on petioles to 8 cm. long, the bracts above these becoming broad, sessile, amplexicaule, and mostly somewhat toothed. *Inflorescence* glabrous, consisting of spaced clusters of few to several sessile or near-sessile

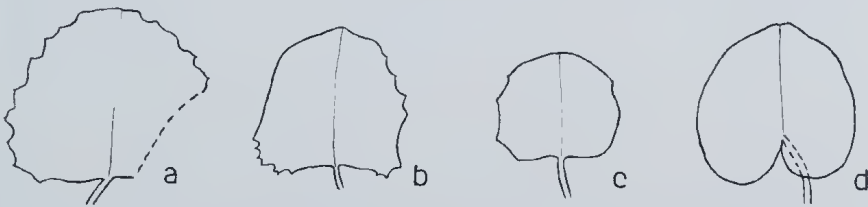


Fig. 10—*V. congestiflora*, shape of radical leaves,  $\times \frac{2}{3}$ . a, b, MEL874. c, d, MEL16483.

flowers forming bundles or congested heads terminating the main branches or very-reduced side-branches, the clusters subtended by broad, entire or toothed involucre bracts. *Flowers* homostylous; calyx-lobes 4–5 mm. long, lanceolate, acute, glabrous; calyx-tube glabrous; corolla yellow, throat fimbriate, the lobes without any longitudinal wing or keel on the inner surfaces. *Capsule* small, 4–5 mm. long, rotund-ellipsoid, 1–2 mm. shorter than the calyx, the lower  $\frac{1}{4}$ – $\frac{1}{2}$  adnate to the calyx-tube, thickly chartaceous, splitting into 4 recurved valves. *Seed* 1–1.4 mm.



long, straw-yellow at first to black at maturity, broad-elliptic to  $\pm$  circular in outline, turgid but compressed, dull, the surface densely and strongly granular, noticeably carunculate with pale cells at the base.

DISTRIBUTION:

West coast of Western Australia, from Perth north to the Murchison River.

HABITAT:

"Moist sand."

FLOWERING TIME:

Fr. recorded in Nov.

TYPEIFICATION:

Syntypes seen—(Sd) Nr. Perth, Swan River, *Oldfield* (MEL872-3), and (Sd) Murchison River, *Oldfield* (MEL874).

DISCUSSION:

The clustered flowers sometimes in dense heads distinguish this species from all others in the genus except *V. capitata* q.v.

SPECIMEN EXAMINED (EXCLUDING TYPES):

WESTERN AUSTRALIA—(Sd) Greenough's and Irwin's River, *F. Mueller*, Nov. 1877 (MEL16482-4) "moist sand".

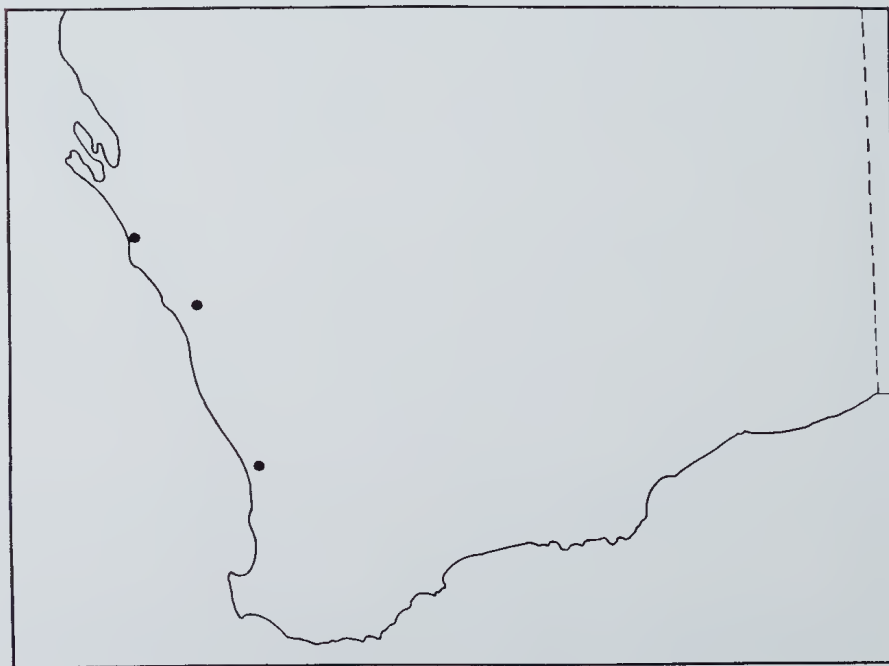


Fig. 11—*V. congestiflora*, distribution map.



3. *Villarsia submersa* H. I. Aston sp. nov.

*Herba* gracillima, omnino submersa (praeter flores), caespitosa, radicata, perennis. Foliorum radicalium *laminae* ellipticae usque ad ovato-lanceolatas, 2.3–6 cm. x 1–2.6 (–3), quam latae bis terque longiores, dorsiventrales, petiolis ad 40 cm. longis praeditae. *Culmus* usque ad 60 cm. longus. *Inflorescentia* laxa paniculata, multiramosa, ramulis vel pedicellis 1–5 ad nodos simul emergentibus; pedicelli 20–70 mm. longi. *Flores* parvi; calycis lobi 3.5–4.5 mm. longi; corolla alba, quam calyx circiter bis longior, intus lanata vel pilosa. *Capsula* 3–3.5 mm. longa, quam lobi calycis circiter 1 mm. brevior, tenue membranacea, ellipsoidea, irregulariter dehiscens ut videtur. *Semen* parvum, 0.6–0.75 (–0.8) mm. longum, glabrum, ellipsoideum, aliquanto lateraliter compressum, stramineum ad fulvum.

A speciebus omnibus aliis *Villarsiae* recedit ob habitum submersum gracillimumque et ob folia elliptica (quam lata multo longiora). Eius semina ad haec *V. parnassifoliae* (Labill.) R. Br. proxime accedunt.

Extremely slender, fine-branched, tufted, apparently non-stoloniferous, aquatic perennial, totally submerged except for the flowers which float on the water surface. *Radical leaves* on very slender petioles to 40 cm. long, expanded at the base; blades elliptic to lanceolate-ovate, 2.3–6 cm. long x 1–2.6 (–3) cm. broad, twice to three times as long as broad, broadly obtuse and mostly slightly emarginate at the apex, rounded to semi-truncate at the base, entire-edged, dorsiventral, upper surface smooth, lower paler and finely-dotted. *Culms* several, to 2 feet long, extremely slender, without cauline leaves or large bracts. *Inflorescence* a much-branched, open, very fine-stemmed panicle, with 1–5 branches or pedicels arising together at the nodes, each subtended by a small, elliptic-ovate-lanceolate, obtuse, sessile bract 2–5 mm. long; pedicels of mature capsules 20–70 mm. long, capillary. *Flowers* small, homostylous; calyx-lobes 3.5–4.5 mm. long, elliptic to ovate-elliptic, obtuse or slightly emarginate; corolla white, apparently about twice as long as the calyx, with the lobes apparently having entire margins, lacking a longitudinal keel, and woolly or hairy with fine fimbriae over the whole of the inner surface; ovary unilocular with 2 parietal placentas,

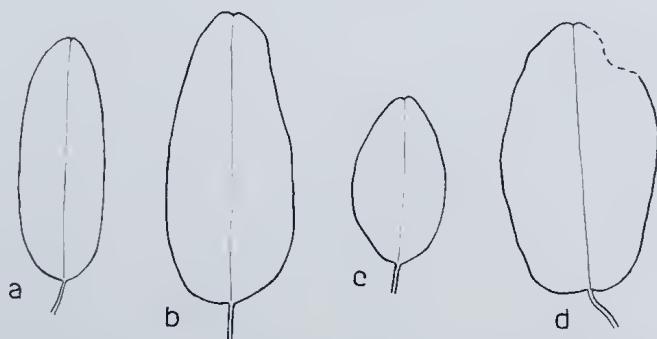


Fig. 12—*V. submersa*, shape of radical leaves, x  $\frac{2}{3}$ . a, b, usual shapes. c, d, extremes. All from R. D. Royce 3778.

ovules ca. 12–15 per placenta, style short and thick, stigma bilobed; anthers linear, bilocular, shortly stipitate, 0.5–0.8 mm. long when dry, 0.9–1 mm. long when boiled. *Capsule* 3–3.5 mm. long, ca. 1 mm. shorter than the calyx-lobes, thinly membranous, ellipsoid, adnate at the base to the calyx, apparently irregularly dehiscent. *Seed* small, 0.6–0.75 (–0.8) mm. long, pale straw-yellow to brown-yellow, ellipsoid, turgid but laterally-compressed, without a conspicuous caruncle, surface smooth and somewhat shining with minute “jig-saw” patterns.

DISTRIBUTION:

Known only from Boyanup, near Bunbury, south-west West Australia, and from King George Sound.

HABITAT:

Rooted in mud in 18 inches of water.

FLOWERING TIME:

Buds, flowers, capsules and seeds present in early September.

TYPEIFICATION:

Holotype—(Sd) Boyanup, *R. D. Royce* 3778, 9.9.1951 (PERTH) “Flrs. white, petals woolly; rooted in mud, leaves and panicle branches wholly submerged. Water 18 in. deep.” Isotype—MEL26022. Paratype—Boyanup, *R. D. Royce* 4343, 16.9.1953 (PERTH; K).



Fig. 13—*V. submersa*, distribution map.

## DISCUSSION:

With its entirely submerged habit (except for the floating flowers), very slender to capillary panicle-branches and pedicels, elliptic, quite non-cordate leaves, small white flowers, small and ? irregularly dehiscent capsules, and small smooth seeds, this species is quite distinct from all others of the genus. In seed characters it appears closest to *V. parnas-sifolia*.

## SPECIMENS EXAMINED (EXCLUDING TYPES):

WESTERN AUSTRALIA—W. A., *Drummond No. 17* (MEL27193); King George Sound, *J. R. Muir* (MEL27192).

4. *Villarsia lasiosperma* F. Muell. *Fragm. Phyt. Aust.* 6 : 137 (March 1868).

Tall, erect, tufted, apparently non-stoloniferous perennial, dotted on the lower culm, petioles, and under-surfaces of leaves. *Radical leaves* erect, on petioles 2–20 cm. long; blades lanceolate to narrow- to broad-elliptic to ovate, longer than broad, 2.5–9.5 cm. long x 1.5–6 cm. broad, apex acute to obtuse, base acute to obtuse to  $\pm$  truncate, edge entire and sometimes undulate, texture mostly thick and semi-succulent, both surfaces matt (or ? upper sometimes somewhat glossy), venation mostly rather obscure above, less so beneath. *Culms* 21 in.–3 ft. (–5 ft.) high, standing erect above the leaves, branching commencing from  $\frac{1}{3}$ – $\frac{1}{2}$  height of culm; cauline bracts sometimes with the lower leaf-like on petiole 2–6 cm. long, or else all bract-like with the lowest either sessile or shortly petiolate. *Inflorescence* an open, diffuse, dichotomous panicle; final bracts 2–3 mm. long, lanceolate, acute; pedicels of mature capsules 8–24 mm. long, slender. *Flowers* homostylous; calyx-lobes 4–7 mm. long, linear- to elliptic-lanceolate, narrow, glabrous or with fine hairs marginal or on the inside surface at the apex, the margins conspicuously membranous; corolla white, apparently about twice as long as the calyx, fimbriate at the throat, each lobe with a longitudinal keel or wing on its inner surface. *Capsule* 4–6 mm. long, equal to or a little < calyx-lobes, globose-ovoid, thickly chartaceous, free from the calyx or attached only at the very base, splitting deeply into 4 acute, recurved valves. *Seed* large, 1.4–1.9 (–2) mm. long, pale straw-yellow in the immature seeds seen but probably darker on ripening (Mueller says “lividis”), ellipsoid, apparently turgid and laterally-compressed when mature, surface with minute “jig-saw” patterns and bearing conspicuous, moderately dense, long, fine, tapered, acute, spinescent tubercles to 0.2 mm. long, without a conspicuous caruncle.

## DISTRIBUTION:

South-west Western Australia, from Busselton to Albany.

## HABITAT:

“Heath swamps”, “Forest swamps”, “Edge of swampy depression”.

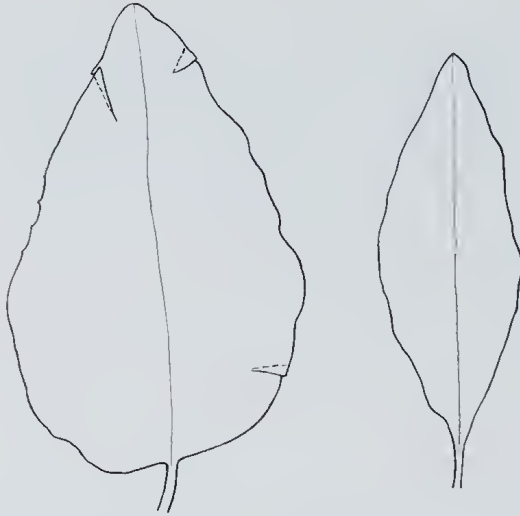


Fig. 14—*V. lasiosperma*, shape of radical leaves,  $\times \frac{2}{3}$ . From MEL876.

FLOWERING TIME:

Fl. and Fr. recorded Oct.-Dec.

TIPIFICATION:

Syntypes seen—(Sd) Swamps at King George Sound, Oct. 1867; Albany; Swamps in the rear of Mt. Melville (various labels on sheet), coll. *F. Mueller* (MEL16493): Heath swamps north of Albany, *F. Mueller*, Oct. 1867 (MEL16494): Swamps at K.G. Sound, Oct. 1867; Forest swamps north of Albany (various labels on sheets), coll. *F. Mueller* (MEL16495; MEL875).

DISCUSSION:

*V. lasiosperma* seems quite closely related to *V. exaltata* (q.v. discussion) of the eastern States, and the two species resemble each other in size, habit, and foliage, and some seed and flower characters. However *V. lasiosperma* is readily distinguished by its white, homostylous flowers with slender calyx-lobes and with the corolla-lobes bearing longitudinal keels, by the capsules not or very scarcely adnate to the calyx, and by its non-carunculate seeds with fine, tapered tubercles. It should not be confused with any western species.

SPECIMENS EXAMINED (EXCLUDING TYPES):

WESTERN AUSTRALIA—(Sd) King George Sound, *G. Maxwell* (MEL877); Blackwood, W.A., *Mrs. McHard* (MEL876); (Sd) Chokarup, *F. Mueller*, 20.12.1877 (MEL16496): Near Wilson's Inlet, also at Chokarup, *F. Mueller*, 22.12.1877 (MEL16497) "Leaves thick, not . . ."; Busselton, *C. A. Gardner*, 27.9.1944 (PERTH); (Sd) 2 miles south of Northcliffe, *T. E. H. Aplin* 1406, 12.12.1961 (PERTH) "Edge of swampy depression".



Fig. 15—*V. lasiosperma*, distribution map.

5. *Villarsia albiflora* F. Muell. *Fragm. Phyt. Aust.* 2 : 21 (Feb. 1860).

Large, tufted, apparently non-stoloniferous perennial, with erect culms and floating leaves, the submerged portions usually conspicuously dotted. *Radical leaves* on petioles (2-) 4-23 (-28) cm. long; blades (1-) 2.5-6 (-7) cm. long x (1-) 2-6 (-7.5) cm. broad, broad-ovate to sub-orbicular to reniform, mostly slightly broader than long or dimensions about equal, apex obtuse to rounded, base cordate with broad rounded lobes sometimes overlapping, sinus narrow and deep (to  $\frac{1}{3}$  length of blade) to broad and shallow, edge entire to slightly crenate or sometimes markedly crenate or toothed, upper surface deeper green and ? glossy, lower surface paler and much-dotted. *Culms* erect, 8 inches to 4 feet high, stout in larger specimens, branching commencing from  $\frac{1}{5}$ - $\frac{2}{5}$  height of culm; cauline leaves usually 1-3 with blades radical-like, on petioles to 9 cm. long. *Inflorescence* an open, many-flowered, dichotomous panicle; final bracts 2-4 mm. long, lanceolate, acute; pedicels of mature capsules (4-) 10-20 (-30) mm. long, slender. *Flowers* homostylous; calyx-lobes 4-7 mm. long, lanceolate to elliptic, acute; corolla white, apparently about twice as long as the calyx, fimbriate at the throat, the lobes without a longitudinal keel. *Capsule* 5-8 mm. long, from sometimes equal to the calyx lobes to usually 1 or 2 mm. longer than them, hard chartaceous, adnate to the calyx only at the base, splitting deeply into 4 valves, the valves erect or tips somewhat recurved. *Seed* 0.8-1.2 mm. long, straw-yellow to yellow-brown (cream-white



when immature), ellipsoid, turgid, slightly compressed laterally, the surface with minute "jig-saw" patterns and also densely covered in short, rigid, hollow tubercles ca. 0.5 mm. long (or rarely these reduced to low granules giving a comparatively smooth seed), without a conspicuous caruncle.

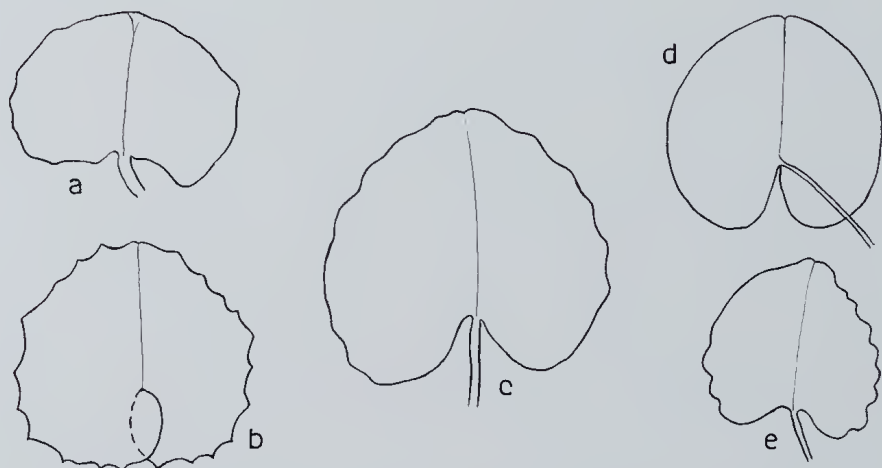


Fig. 16—*V. albiflora*, shape of radical leaves,  $\times \frac{2}{3}$ . a, MEL16430. b, NSW77139. c, H. W. Alcock, Sept. 1896. d, MEL16439. e, MEL16444.

#### DISTRIBUTION:

South-west Western Australia, from about 80 miles north of Perth south through Perth and York to the Cape Leeuwin area, and also found in the Porongorups.

#### HABITAT:

Fresh-water swamps, lake edges, streams, etc., in water to at least 1 foot deep and apparently also in boggy places. Recorded on laterite, in Jarrah forests, and among stones of a river bed. Associated with *Melaleuca laterita* (in one report).

#### FLOWERING TIME:

Fl. and Fr. recorded Sept.-Jan.

#### TIPIFICATION:

Mueller in his original description cites "In stagnis prope oppida Perth et Hampden. Clarke et Oldfield." The National Herbarium of Victoria holds two sheets (MEL16430 and 16447) labelled "Hampden, W.A., Oldf." and "Perth, W.Aust., Oldf." respectively in Oldfield's hand, both labels being annotated as *V. albiflora* by Mueller himself. These are regarded as syntypes. Both specimens show vegetative parts.



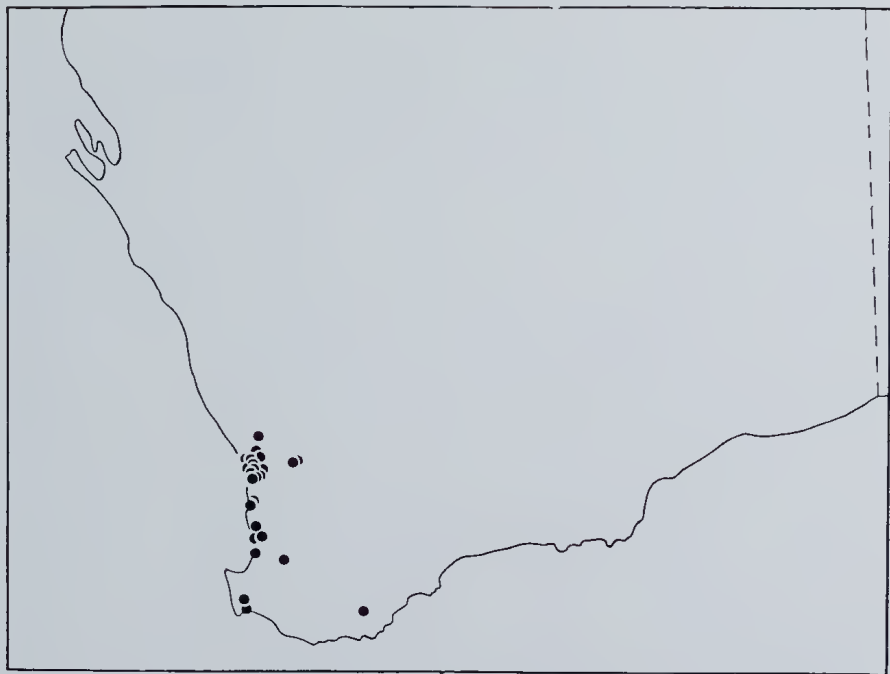


Fig. 17—*V. albiflora*, distribution map.

buds and flowers only, and as seeds are of such importance within the genus Kew Herbarium was approached to ascertain if further syntypes with seed or even young capsules were available there. A sheet bearing two specimens and labelled (amongst others) "fl. white. Monger's Lake, Nr. Perth, W.Aust." in Oldfield's hand, with the additional annotation "*albiflora* F. Muell." again in Oldfield's hand was located, but it bears no handwriting of Mueller. A photograph (Kew negative No. 8566) of the sheet has been compared with the Melbourne syntypes and is in agreement both concerning the specimens and the label handwriting. It must be regarded as possible syntype material, as Mueller did not always annotate sheets seen by him. However, it is most likely that Mueller did not see the Kew sheet at all, the material on it being sent directly to J. D. Hooker by Oldfield himself.

As Mueller's original description stated "*Capsula adhuc ignota*" (capsule so far unknown) it was expected that any material held by Kew would lack capsules and seeds, and Sir George Taylor in a letter dated July 6, 1966, confirmed this. Referring to the Kew sheet mentioned above he stated "These specimens are evidently in the same state as your own with buds and only the first flowers opening. There are no capsules not even young ones developed, . . .". Fortunately Mueller, subsequent to his original diagnosis, made two further descriptive references to *Villarsia albiflora*, including references to the seed of the species and citing further material examined. In *Fragm. Phyt. Aust.*

5 : 46 (1865) he cited "Haec planta ad flumen Blackwood's River occurrit", and in l.c. 6 : 138 (1868) he stated "Huc planta Drummondi 4". The National Herbarium of Victoria holds a sheet (MEL16434) collected by Oldfield at the Blackwood River and also a Drummond No. 4 specimen (MEL16435), both annotated by Mueller as *V. albiflora* and both with seeds agreeing with Mueller's description. These sheets are here regarded as homoeotypes.

With his original diagnosis, Mueller synonymised "*V. reniformis*, Nees in *Lehm. pl. Preiss.* 1.364, non R. Br.". At this reference, Nees placed *Herb. Preiss* No. 1958 under *V. reniformis* R. Br. Sir George Taylor in a letter from Kew dated July 6, 1966, suggested that it could be argued that Mueller was basing his species partly on *V. reniformis* Nees in *Pl. Preiss.* 1 : 364 (non R. Br.), and forwarded a Kew sheet of *Preiss* 1958 to Melbourne for examination. This sheet does not bear *Preiss*' number but is labelled ". . . in stagnantibus prope Perth 1839.10.25" and "Swan River *Preiss*" in agreement with data given by Nees and has the identification "*reniformis* R. Br." subsequently altered by Bentham to "*V. albiflora* F. Muell.". It contains seed and both it and two other specimens of *Preiss* 1958 held at Melbourne (MEL16431 and 16433) also with seed, agree with the homoeotype material cited above. I am quite in agreement that the three sheets of *Preiss* 1958, and the syntype and homoeotype material cited are all conspecific, but cannot see why *Preiss* 1958 should be regarded as type material. If Nees had actually published *V. reniformis* Nees as his own name then certainly the *Preiss* collection would be a type of *V. albiflora* F. Muell. However, Nees had no intention of using a new name or describing a new species, but simply mistook *Preiss* 1958 as belonging to *V. reniformis* R. Br., and placed it under that name. The name *V. reniformis* Nees has therefore never been published, has no standing, and cannot have any type. Mueller may not have intended his mention of it to be taken as a direct synonymy, but only to indicate that the entity Nees circumscribed belonged under *V. albiflora* F. Muell. rather than under *V. reniformis* R. Br. This view is now accepted by Sir George Taylor and is held also by Mr. J. H. Willis of Melbourne.

#### DISCUSSION:

This species is very similar in foliage to *V. reniformis* and in seed to *V. umbricola* var. *beaugleholei*, but both of these are confined to the eastern States. *V. albiflora* is distinguishable however by its combination of densely-tuberculate, rough seeds, white corollas without any longitudinal wings on the inner surfaces of the lobes, and its cordate, dorsi-ventral foliage with blade length  $\pm$  equal breadth.

Two collections show variation from the typical, tuberculate seed. Oulina (Helena R.), Max Koch, 1907 (NSW90554) has two specimens, one with typical seed, the other with the tubercles reduced and in places absent, being represented then only by small granular swellings on the seed surface. Morley Park, N. G. Marchant 191, 1958 (PERTH) has no tubercles but only a granular surface. It is otherwise a good example of *V. albiflora*.

## SPECIMENS EXAMINED (EXCLUDING TYPES) :

WESTERN AUSTRALIA—(Sd) "In stagnantibus prope Perth", *Preiss* 1958, Oct. 1839 (KEW); (Sd) *Preiss* No. 1958 (MEL16431 and 16433); Blackwood River, *Walcott*, Jan. 1868 (MEL16432) "Growing in swampy ground near Fennels station"; (Sd) Between Perth and York, *F. Mueller*, Nov. 1877 (MEL16437-8) "Swamps", also [in Latin] Corolla white, lobe margins naked, throat fimbriate, lobes not longitudinally crested; (Sd) Swan River, *F. Mueller*, Nov. 1877 (MEL16439) "Jarrah forests"; (Sd) Swan River, Darling Ranges, *F. Mueller*, Nov. 1877 (MEL16436, 16444-5, 16448) "Vallies", "Rivulets"; Serpentine River, *F. Mueller*, 1.12.1877 (MEL16449) Corolla white, lobes ovate not crested, throat fimbriate [in Latin], "Cataracts, brooks . . ."; (Sd) Harvey's River, *F. Mueller*, 5.12.1877 (MEL16443) Corolla lobes white . . . not crested. Leaves paler green beneath and less shining [in Latin]; (Sd) Blackwood River, W.A., *Mrs. McHard*, Dec. 1884 (MEL16441); (Sd) Swan District, *H. W. Alcock*, Sept. 1896 (PERTH); Bunbury, *R. Helms*, 27.9.1897 (PERTH); (Sd) Bunbury, Geographe Bay, *R. Helms*, 27.9.1897 (NSW77139); Cannington, *R. Helms*, Sept. 1898 (NSW90553); (Sd) Bayswater, *A. Morrison* 9429, 6.12.1899 (PERTH); Bayswater, lower Swan River, *A. Morrison* 10330, 10.10.1900 (NSW90552); (Sd) Bayswater, Swan District, *Diels & Pritzel* 503, Nov. 1900 (PERTH); (Sd) Darling Range, *J. B. Cleland*, 190? (NSW90550); (Sd) Cannington, Swan District, *Miss Lambert*, Nov. 1901 (PERTH); (Sd) Mandurah, *A. G. Hamilton* 551, 1902 (NSW90555); (Sd) Near Perth, *W. V. Fitzgerald*, Oct. 1902 (NSW90551) "Fl. white"; (Sd) Oulina (Helena River), *Max Koch*, 26.11.1907 (NSW90554); (Sd) York, *J. B. Cleland*, Dec. 1907 (NSW549); (Sd) Harvey, *F. H. Steward*, Nov. 1916 (PERTH); Collie River, *Muja, C. A. Gardner*, 8.4.1922 (PERTH); (Sd) Scott River, *R. D. Royce* 61, 17.1.1945 (PERTH) "Flowers white, leaves thick. Among stones in bed of river"; (Sd) Gnangarra, *C. A. Gardner*, Oct. 1945 (PERTH) "fls. white" "on shores of lake"; (Sd) York, northern turn-off, "The Lakes", *D. Churchill*, Dec. 1957 (PERTHU) "in swamp over laterite assoc. with *Melaleuca laterita*"; (Sd) Walter Road, Morley Park, *N. G. Marchant* 191, Oct. 1958 (PERTH) "aquatic, leaves floating, water 9" deep, flowers white"; (Sd) Porongorup Range, slopes of Nancy's Peak, *G. G. Smith*, 10.11.1960 (PERTHU); Chittering Valley, *G. G. Smith*, 27.9.1961 (PERTHU) "in open marsh in paddock, petals white—not keeled internally".

6. *Villarsia violifolia* F. Muell. *Fragm. Phyt. Aust.* 6 : 138 (March 1868).

Small, low, stoloniferous, mat-forming perennial. *Radical leaves* on petioles 1.5–15 cm. long; blades small, (4–) 8–20 (–28) mm. long x (5–) 8–25 (–32) mm. broad, mostly semi-rounded to broader than long (up to  $1\frac{2}{3}$  as broad as long) but ranging from elliptic (rarely) to broad-ovate also, apex obtuse to rounded, base obtuse to truncate to slightly cordate, or rarely the sinus up to  $\frac{1}{3}$  length of the blade, edge entire or almost so, texture thin, surfaces semi-matt, or the upper somewhat glossy. *Culm* slender, 4.5–11 (–15) cm. high, branches few, lower nodes with linear-lanceolate bracts only or sometimes cauline leaves on petioles 1–4 cm. long. *Inflorescence* 2-several flowered, the pedicels rising singly from the culm branches or paired, very slender, those of mature capsules 9–30 mm. long. *Flowers* homostylous; calyx-lobes 3–5 mm. long, narrow-lanceolate, acute; corolla yellow, a little longer than the calyx, fimbriate at the throat, the lobes without longitudinal keels or wings on the inner surfaces. *Capsule* 3–5 mm. long, 1–3 mm. shorter than the

calyx, the lower  $\frac{1}{3}$ – $\frac{1}{2}$  adnate to the calyx-tube, thickly chartaceous, opening into 4 distinct, recurved valves. Seed 1.4–1.7 (–1.8) mm. long, straw-yellow to fawn-brown or brown-black, ellipsoid, turgid, somewhat laterally compressed, smooth and glossy or matt, surface with minute reticulated patterning, carunculate with an almost-basal, circular, hollow projection of translucent, semi-papillose tissue.

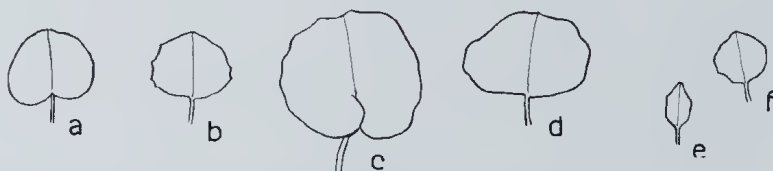


Fig. 18—*V. violifolia*, shape of radical leaves,  $\times \frac{2}{3}$ . a, b, MEL16491–2. c, d, NSW90559, e, f, NSW90560.

#### DISTRIBUTION:

South-west Western Australia, from Perth southwards to the Pemberton and Lake Muir Districts.

#### HABITAT:

In shallow freshwaters, and on wet soil.

#### FLOWERING TIME:

Fl. and Fr. recorded Dec.–Feb.

#### TIPIFICATION:

Syntypes seen—(Sd) Don River, *Maxwell* (MEL16491–2); (Sd) S.W.Austr., *Mr. Clarke* (MEL16489); Tweed R., W.Austr., *Oldfield* (MEL16490) “plts. matted fl. yellow”.

#### DISCUSSION:

A small, stoloniferous, mat-forming species, with short culms and open, few-flowered inflorescences. Similar in calyx-lobes, capsule, and seed to *V. latifolia*, but the caruncle rather less prominent.

#### SPECIMENS EXAMINED (EXCLUDING TYPES):

WESTERN AUSTRALIA—(Sd) West Australia (MEL16488); (Sd) Upper Warren River, *F. Mueller*, 12.12.1877 (MEL16486–7) “In water and at its edge”; (Sd) Lake Muir, *Muir*, 1878 (MEL16485); Kelmscott, Canning River, *Alex Morrison* 9428, 21.12.1899 (NSW90558; PERTH) “swamp”; (Sd) Swan district, *E. Pritzel*, Dec. 1900 (NSW90561); (Sd) Burswood, W.A., *W. V. Fitzgerald*, Dec. 1900 (NSW90560) “wet soil Fl. yellow”; Big Brook, *Max Koch*, Nov. 1920 (PERTH) “grows in very moist places”; (Sd) Big Brook, Warren District, W.A., *Max Koch* 2545, 21.1.192? (NSW90559); (Sd) Jandakot, *R. D. Royce* 5831, 24.2.1959 (PERTH).



Fig. 19--*V. violifolia*, distribution map.

7. ***Villarsia calthifolia*** F. Muell. *Fragm. Phyt. Aust.* 6 : 140 (March 1868).

Large, erect, robust, apparently non-stoloniferous perennial. *Radical leaves* large, on petioles 1–2 feet long; blades 5–16 cm. long x 6–19 cm. broad on herbarium specimens but noted by Mueller as almost 1 foot long and broad, almost round or either dimension slightly exceeding the other, apex rounded, base deeply cordate, sinus narrow, to  $\frac{1}{3}$  ( $-\frac{2}{5}$ ) length of blade, basal lobes sometimes overlapping, margin strongly and irregularly toothed or teeth sometimes less pronounced, the teeth tips callose, texture thin to medium, upper surface glossy or matt, lower surface lightly dotted, veins quite noticeable at least below. *Culm* erect, measured to 3 feet high on incomplete specimens while Bentham (1868, p. 374) cites Drummond as recording heights of 7–8 feet; cauline leaves present, at least the lower 4 radical-like, the blades to 7.5 cm. long x 10.5 cm. broad on petioles to 19 cm. long. *Inflorescence* a many-flowered panicle, the final branches and pedicels short, giving a semi-open to compact but not over-dense appearance; final bracts 5–7 mm. long, broad-lanceolate to elliptic, acute; pedicels of mature capsules 7–12 mm. long. *Flowers* homostylous; calyx-lobes 6–9 mm. long, broad-elliptic to broad-ovate, acute; corolla yellow, fimbriate at the throat, the lobes without any longitudinal keel or wing on the inner surfaces. *Capsule* (6–) 7–9 mm. long, equal to or slightly greater than to up to 1.5 mm. longer than the calyx, broad-ovoid to  $\pm$  urceolate, adnate at

the base to the calyx tube, the apex and style usually falling by circumscission, the remaining capsule opening by a circular pore or by 4 (or secondarily more) valves at the summit, the valves truncate, remaining erect or turning slightly outwards, rarely somewhat recurved; capsule wall often thickened beneath the line of circumscission. *Seed* large, 1.5–1.8 mm. long, straw-yellow to brownish, ellipsoid, very turgid, somewhat laterally compressed, the surface with a minute, reticulated pattern and densely covered with short, hollow, tapered tubercles, without a conspicuous caruncle.

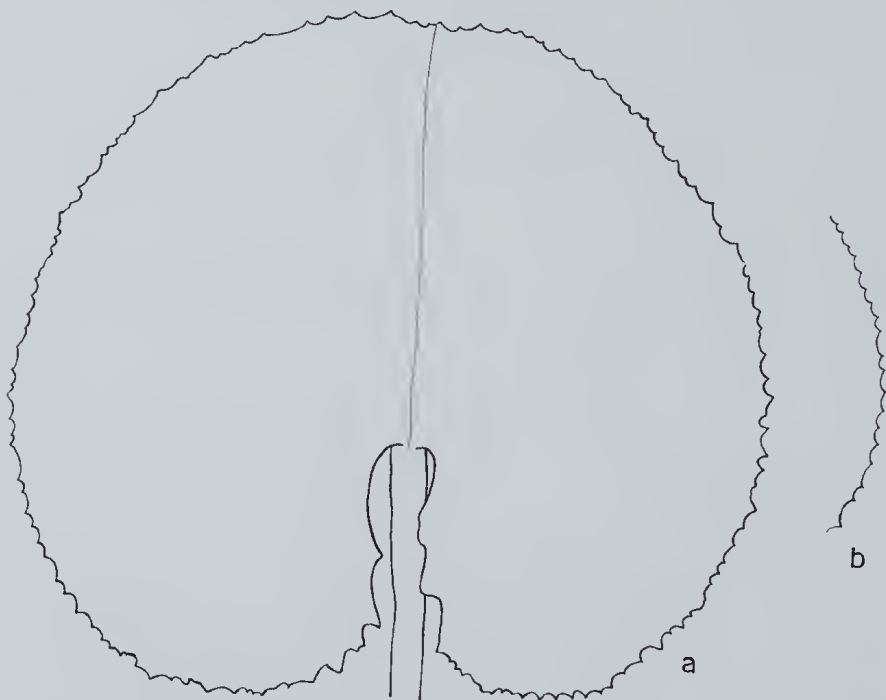


Fig. 20—*V. calthifolia*, radical leaf,  $\times \frac{2}{3}$ . a, MEL16481. b, A. C. Beaglehole 12790.

**DISTRIBUTION:**

South-west Western Australia, confined to the Porongorup Ranges.

**HABITAT:**

Moist, shaded or sheltered positions amongst granite boulders.

**FLOWERING TIME:**

Fl. reported Oct.-Dec., Fr. recorded Dec.

**TIPIFICATION:**

Syntypes seen—Porongorup, *F. Mueller*, Oct. 1867 (MEL16480–1) “Cor. yellow”; (Sd) Porongorup, *F. Mueller* (NSW90574).



## DISCUSSION:

A distinctive plant with its large and robust habit, large, circular, cordate, toothed foliage, more compact inflorescence, large, broad, circumscissile capsules with truncate valves, and large, turgid, densely tuberculate seeds without any conspicuous caruncle.

## SPECIMENS EXAMINED (EXCLUDING TYPES):

WESTERN AUSTRALIA—(Sd) W.A., *J. Drummond* No. 5 (MEL16476-8); Porongorup, *Mrs. Knight*, 1870 (MEL16479); (Sd) Porongorup Range, *J. Hale*, Dec. 1939 (PERTH) "Amongst granite rocks, in moist spots. fl. yellow"; Devil's Slide, Porongorup Range, *T. E. H. Aplin* 2164, 20.10.1962 (PERTH) "in shaded crevices"; (Sd) Top of Nancy's Peak, Porongorups, *A. S. George* 6477, 8.12.1964 (PERTH) "Perennial herb. Basal lvs. dying off. Fls. yellow. S. side of granite boulders"; Devil's Slide, Porongorups, *A. C. Beauglehole* 12790, Sept. 1965 (Herb.A.C.B.).



Fig. 21—*V. calthifolia*, distribution map.

8. *Villarsia latifolia* Benth. in Endl. et al. *Enum. Plant. Hueg.* 81 (1837).

Tall, erect, tufted, apparently non-stoloniferous perennial. *Radical leaves* erect, on petioles 6–15 cm. long; blades 5–7 cm. long x 4–5 cm. broad, broad-ovate to  $\pm$  circular to a little broader than long, apex obtuse to rounded, base rounded to truncate, edge crenate-dentate, texture thin, upper surface ? somewhat glossy, lower surface ? also somewhat glossy with veins prominent. *Culm* erect, 1 ft.–3 ft. 2 in. high,

branching commencing from about  $\frac{1}{4}$ – $\frac{1}{2}$  height of culm; cauline leaves rising from the lower 2–6 nodes of culm, 1–4 arising together at each node, radical-like blades to 7.5 cm. long x 8.5 cm. broad on petioles 2–34 cm. long, the cauline bracts above these becoming bract-like and sessile. *Inflorescence* an open to semi-open dichotomous panicle, the pedicels arising singly or more usually the panicle branches and pedicels found in near-whorls of 2–5 together; final bracts narrow, lanceolate, acute, 2–3 mm. long; pedicels of mature capsules 5–11 mm. long. *Flowers* homostylous; calyx-lobes (3–) 5–7 mm. long, lanceolate, acute, noticeably slender; corolla yellow, from description possibly not much longer than the calyx, said to be smaller than that of *V. parnassifolia*, fimbriate at the throat, each lobe without a longitudinal keel or wing. *Capsule* 2–5 mm. long, 1–2 mm. shorter than the calyx, globose or subglobose, the lower  $\frac{1}{4}$ – $\frac{1}{3}$  adnate to the calyx-tube, thickly chartaceous, opening into 4 distinct recurved valves. *Seed* large, (1.5–) 1.6–1.8 (–1.9) mm. long, straw-yellow to pale yellow-brown, ellipsoid, very turgid, smooth and very finely and minutely patterned only, glossy or sometimes matt, with a prominent, projecting,  $\pm$  circular, translucent caruncle just lateral to the base.

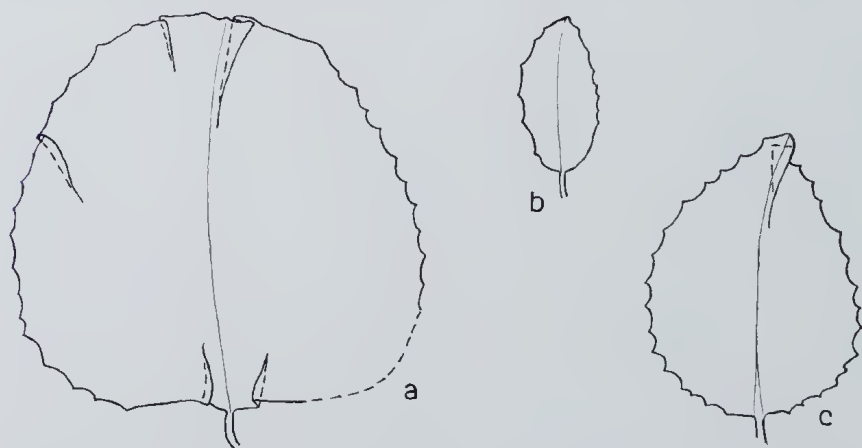


Fig. 22—*V. latifolia*, shape of leaves, x  $\frac{2}{3}$ . a, cauline leaf, MEL16459. b, MEL16464. c, MEL16460. b and c are radical leaves.

#### DISTRIBUTION:

South-west Western Australia, from near Harvey to near Pemberton, and at King George Sound.

#### HABITAT:

In water or on wet soil of swamps and river banks. Recorded in granite hills.

#### FLOWERING TIME:

Fl. and Fr. recorded Dec.–Feb.

# TYPIFICATION:

Type not seen—King George Sound, *Huegel*. Specimens examined include several initialled and/or cited by Bentham (1868). These are indicated below by the symbol (B).

# DISCUSSION:

*V. latifolia* should be readily distinguished from the other large, loose-panicked, yellow-flowered species by its thin-textured, broad, crenate-dentate, non-cordate foliage with raised venation beneath, the several radical-type cauline leaves (at least on large plants), the usually grouped pedicels, the slender calyx-lobes, the capsule shorter than the calyx and adnate to it below, and the distinctive large, smooth, carunculate seed which resembles only that of *V. violifolia*. *V. violifolia* is otherwise, however, a quite different plant.

# SPECIMENS EXAMINED:

WESTERN AUSTRALIA—(B) *Preiss No. 1955* (MEL16461-2); (B) (Sd) West Austr., *Drummond No. 3* (MEL16453-4); (B) (Sd) W.A., *J. Drummond* not numbered but probably also *No. 3* (MEL16457); (B) W. Australia, *Drummond No. 3* (NSW90568); (B) W.A., *J. Drummond No. 163* (MEL16467); (B) W. Austr., *Drummond No. 4* (MEL16464-5; NSW90567); (B) Swamps near the Blackwood, *Oldfield 131* (MEL16463); (B) (Sd) Blackwood River, *P. Walcott*, Jan. 1868 (MEL16455-6) "River Banks of granite Hills 20 miles from coast" "Growing in Swamps near the Blackwood River. 15 miles from



Fig. 23—*V. latifolia*, distribution map.

coast and 30 from Cape Leeuwin"; Warren River, *P. Walcott*, Feb. 1872 (MEL16466) "Karri Hills and Banks of Streams"; (Sd) Preston River, *F. Mueller*, 5.12.1877 (MEL16450-1) in drying swamps, corolla lobes yellow, not crested, dilated terminally, leaves concolorous, shining on both sides [in Latin]; Banks of the Harvey River, *F. Mueller*, 5.12.1877 (MEL16458-9) corolla yellow, apex of the lobes truncate-obtuse, not crested, throat fimbriate. Foliage on both sides shining and deeply green, concolorous [in Latin]; (Sd) Preston & Collie Rivers, *F. Mueller*, 7.12.1877 (MEL16452), Blackwood and Preston River, *F. Mueller*, 8.12.1877 (MEL16460) "4'. On banks (not in water) . . ."; (Sd) Lowden, *Max Koch* 1993, Dec. 1909 (NSW90565); Lowden, *Max Koch* 1993, Jan. 1910 (PERTH); Big Brook, *Max Koch*, Jan. 1910 (PERTH); (Sd) Greenbushes, *R. H. Pullein*, Dec. 1917 (NSW90566); Yallingup, *W. E. Blackall*, Dec. 1930 (PERTH) "flowers yellow"; West of Harvey, *C. A. Gardner*, Sept. 1941 (PERTH).

9. ***Villarsia parnassifolia*** (Labill.) R. Br. *Prodr. Flor. Nov. Holl.* 457 (April 1810) p.p.

*Swertia parnassifolia* Labill. *Nov. Holl. Plant. Specim.* 1: 72, t.97 (1805).

Erect, tufted, non-stoloniferous perennial. *Radical leaves* erect on petioles (1-) 2.5-14 (-18) cm. long; blades elliptic, ovate, sub-rotund, to sometimes broader than long, (0.7-) 1-4.5 (-5.5) cm. long x (0.4-) 0.7-3.5 (-4) cm. broad, apex acute to obtuse or rounded, base (acute to) rounded or truncate (to sometimes slightly cordate), margin sub-entire to crenate or crenate-dentate, sometimes markedly so, texture thick, apparently semi-succulent, not markedly dorsi-ventral although sometimes smoother above, surfaces apparently both matt, the veins often inconspicuous or the major ones only visible. *Culm* (6-) 11-24 (-32) inches high, the lowest branch found at ( $1\frac{1}{4}$ -)  $\frac{1}{4}$ - $\frac{1}{2}$  ( $-\frac{3}{4}$ ) height of culm; cauline bracts either all bract-like, the lowest sessile or with a broad, semi-stem-clasping petiole, or else the lowest leaf-like with petiole 1.5-8 cm. long. *Inflorescence* an open, dichotomous panicle or occasionally by reduction of the internodes up to 4 panicle branches and pedicels arising almost together; final bracts lanceolate-acute, 2-3 mm. long; pedicels (of mature capsules) 7-24 mm. long, erect. *Flowers* described as heterostylous by Bentham (1868, p. 376) but no mention of heterostyly made by Labillardiere in his original description or by subsequent collectors; calyx-lobes (3.5-) 5-7 (-9) mm. long, lanceolate to elliptic, acute; corolla yellow, apparently about twice as long as the calyx, fimbriate at the throat, the lobes acute to broadly-truncate at the apex, without a longitudinal keel. *Capsule* (4-) 6-8 (-10) mm. long x 2-3 mm. broad, from rarely slightly < to usually 1-2 mm. > calyx-lobes, membranous, lanceolate to narrow-ovate or pyriform in outline, usually appearing slender, adnate to the calyx-tube only at the base, the valves opening only at the apex and often appearing several. *Seed* 0.5-0.8 (-1) mm. long, straw-yellow to light-brown, turgid, compressed broad-ellipsoid to almost globular, without a conspicuous caruncle; surface with minute "jig-saw" or entire patterns, slightly granular, occasionally tuberculate with small, dense, blunt tubercles.

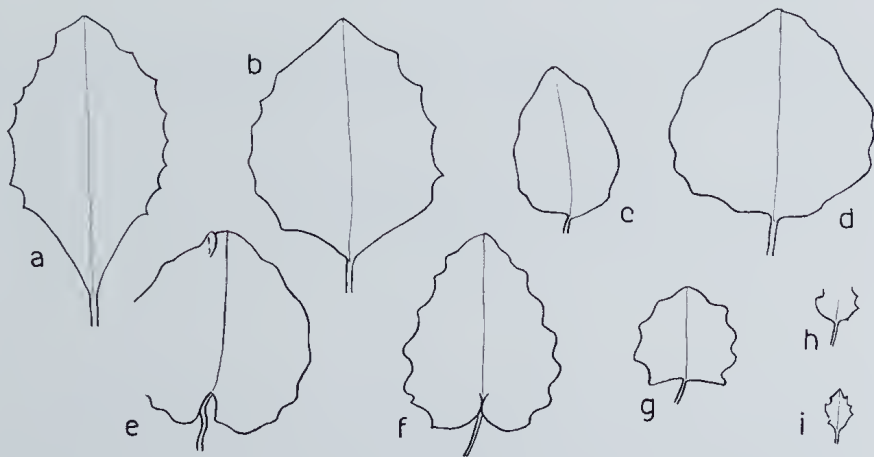


Fig. 24—*V. parnassifolia*, shape of radical leaves,  $\times \frac{2}{3}$ . a to d, MEL16369 and 16373. e, MEL16368. f, NSW77140. g, NSW90564. h, i, MEL16384.



Fig. 25—*V. parnassifolia*, distribution map.



## DISTRIBUTION:

South-west Western Australia, from the vicinity of Busselton and Cape Leeuwin eastwards to about 30 miles east of Esperance.

## HABITAT:

Shallow waters in or around freshwater swamps, etc., or on wet flats subject to periodic drying. Apparently mostly in sandy soil. Recorded once in association with *Banksia littoralis*.

## FLOWERING TIME:

Fl. reported Oct.-Jan., Fr. Oct.-April.

## TYPIFICATION:

Under *V. parnassifolia* Brown included both *Swertia parnassifolia* Labill. and *Menyanthes exaltata* Soland. ex Sims. The latter species is however quite distinct, and is here completely excluded from the circumscription of *V. parnassifolia* (Labill.) R. Br.

Type material "in terra Van-Leeuwin", i.e., Esperance Bay, should be in Labillardiere's Herbarium acquired by Webb and now at Florence. Professor Guido Moggi, Herbarium Universitatis Florentinae, Florence, forwarded photographs of a sheet found in the Webb Herbarium, and bearing two different collections. The right hand collection on the sheet is a Labillardiere collection, and the left hand one belongs to the Desfontaine Herbarium. The hand written label "*Swertia parnassifolia* t. 97 Coll. n. holl." on the right hand collection is apparently Labillardiere's own, and the specimens belonging with it should be regarded as type material of *Swertia parnassifolia* Labill. In addition, the British Museum (Natural History) holds a Labillardiere specimen with an original label "*Swertia parnassifolia*. n.h.pl. sp. tab. 97" and this agrees well in habit and appearance with the Florence photo and may be taken as a duplicate of the type collection in Florence. A photograph of the British Museum specimen was forwarded by Dr. W. T. Stearn to Melbourne where it is seen to agree well with a *Swertia parnassifolia* sheet collected by Labillardiere and previously sent as a donation by the British Museum to the National Herbarium of Victoria. This sheet (MEL16384) should also be taken as a duplicate of the type gathering. The National Herbarium of New South Wales, Sydney, has a similar duplicate (NSW90562) of the type gathering donated from the British Museum. The Florence, British Museum, Melbourne and Sydney collections are all in general agreement with the plate provided by Labillardiere except that the leaves are sometimes more strongly toothed than is shown in the illustration.

In his description of *Swertia parnassifolia* Labillardiere described the seeds as many, globose, finely scrobiculate, pale, and straw-yellow. As seeds have proved to have great diagnostic value in the genus *Villarsia*, those of the four type collections have been matched against each other and appear identical. They also agree very well with Labillardiere's description except for the colour being more pale-brown

than straw-yellow, possibly due to darkening with age. Those from the Melbourne collection are sub-globular and 0.5–0.6 mm. in diameter, and several were forwarded to the B.M. where Dr. Stearn compared them with the one seed available on the specimen there. He reported this (letter Jan. 2, 1967) as “subglobose, approximately 0.5 mm. in diameter, with the surface not tuberculate but marked into numerous minute areas exactly as in MEL16384 sent for comparison”. Seeds from the Florence collection were forwarded to Melbourne where comparison with MEL16384 showed them identical in surface patterning and apparently similar in shape and size. Precise measurement could not be made due to squashing of the seeds in transit. Seeds of NSW90562 agree well with those of Melbourne in all respects.

Enquiries sent to the Director, Conservatoire et Jardin Botaniques, Geneva, revealed that there is no type material of *Swertia parnassifolia* there. From the four type sheets located I now select the major specimen held at Florence as lectotype. The British Museum, Melbourne, and Sydney specimens thus become isolectotypes.

#### DISCUSSION:

This species has been erroneously recorded for South Australia by Black (1957, p. 693). I have seen no specimen of it from that State, and records of its occurrence there seem to be due to confusion with the newly-described species *V. umbricola*.

*V. parnassifolia* has distinctively small, turgid, usually non-tuberculate seeds unlike those of other species, except *V. submersa* q.v. The thickish, crenate-dentate, often non-cordate foliage, and slender, membranous often pyriform capsules mostly well-exceeding the calyx are also helpful for identification.

#### SPECIMENS EXAMINED (EXCLUDING TYPES):

WESTERN AUSTRALIA—(Sd) *Preiss No. 1957* (MEL16375); (Sd) W.A., *Drummond No. 6* (MEL16378; NSW90563); (Sd) S.W.Austr. (MEL16381); (Sd) Orleans Bay, *Maxwell* (MEL16380) “Next bay east from Lucky Bay . . .”, i.e. Mississippi Bay, not the present Duke of Orleans Bay; (Sd) S.W.Austr., *Tone River* (MEL16379); (Sd) *Kalgun River, Oldfield 130* (MEL16368); (Sd) *Moirs Inlet, Phillips and Fitzgerald Rivers* (MEL16377); (Sd) Near Cape le Grand, *Maxwell* (MEL16376) “Around fresh water swamps”; (Sd) Cape le Grand, *Maxwell* (NSW90564); (Sd) Bald Island, *Maxwell* (MEL16383); (Sd) Swamps around King George Sound and into the interior, *G. Maxwell* (MEL16382); (Sd) *Wilson’s Inlet, F. Mueller*, Dec. 1877 (MEL16369–73) “on places drying up” “Wet flats, periodically dry” “Lobes of corolla (yellow) entire, broadly truncate, not crested” “Almost terrestrial”; (Sd) Porongorup, *Mrs. Knight* (MEL16446); (Sd) Busselton, *Dr. T. C. Rosselloty* (MEL16366); (Sd) Lake Muir, W.A., *Muir* (MEL16367); (Sd) King Georges Sound, *Webb*, Dec. 1882 (MEL16374); (Sd) King George’s Sound, *J. H. Maiden*, Nov. 1909 (NSW77140–1); (Sd) Nillup via Margaret River, *R. D. Royce 13*, 14.1.1944 (PERTH) “Petals yellow, villous. 12–24 inches tall”; (Sd) 3 miles N. of Esperance, *R. D. Royce 4115*, 21.4.1953 (PERTH); (Sd) 4 miles E. of Albany, *J. W. Green 868*, 1.12.1956 (PERTH) “Herb 80 cm. high; fls. yellow. In water. Swampy sand, assoc. with *Banksia littoralis*”; (Sd) 12 miles W. of Denmark, on Manjimup Road, *A. R. Fairall 631*, 12.10.1962 (PERTH) “Plant 2’. Yellow fl. Succulent foliage” “Growing in water”; (Sd) 11 miles from Denmark, towards

Manjimup, M. E. Phillips, 12.10.1962 (CBG) "In wetland patch in swamp. Sandy peat." "yellow"; (Sd) Cape Augusta, A. R. Fairall 813, 18.10.1962 (PERTH) "Herb 18". Flowers yellow"; (Sd) Albany-Denmark road, 18 miles W. of Albany, T. E. H. Aplin 2179, 20.10.1962 (PERTH) "swampy soil"; 23 miles E. of Esperance, M. E. Phillips, 4.11.1962 (CBG) "1 ft. high, in sandy soil."

10. **Villarsia exaltata** (Soland. ex Sims) G. Don *Gen. Syst.* 4 : 169 (1838).

*Menyanthes exaltata* Soland. ex Sims in *Curtis's bot. Mag.* 26 : sub.t.1029 (1807), *icone excluso*.

Erect, usually robust, tufted perennial, without stolons. *Radical leaves* rising erect, never floating, on petioles ( $3\frac{1}{2}$ –) 5–16 (–24) in. long; blades usually ovate-elliptic, broad-lanceolate, narrow-ovate or broad-ovate and longer than broad to rarely rhomboid or sub-rotund and length  $\pm$  equal breadth, to very rarely the breadth slightly  $>$  length, outline often somewhat irregular, (4–) 6–12 (–13.5) cm. long  $\times$  (1.5–) 3–8 (–9.5) cm. broad, apex acute to obtuse or rounded, base mostly rounded to shallowly cordate, occasionally truncate or oblique, edge entire or sometimes slightly to  $\pm$  strongly crenate-dentate, often undulate, surfaces matt and  $\pm$  uniform in coloration or upper surface slightly darker, texture thick and at times almost semi-succulent, veins not markedly pronounced. *Culms* 1-several, 18 in.–5 ft. high, standing erect well above the radical leaves; cauline leaves 1-several, solitary at each node or several together, usually subtending a panicle branch but the lower ones not always doing so, lowest leaf arising at about the level of the blades of the radical leaves, in larger plants at least the lower 2 cauline leaves similar to the radical leaves, on petioles (1–) 2–7 (–11) in. long and semi-sheathed at the base. *Inflorescence* an open, many-flowered panicle; final bracts ovate, acute, (2–) 4–5 mm. long; pedicels (of mature capsules) 4–13 (–18) mm. long, remaining erect. *Flowers* heterostylous; calyx-lobes 4.5–8 mm. long, lanceolate-ovate, acute, ( $\frac{1}{3}$ –)  $\frac{2}{5}$ – $\frac{1}{2}$  (– $\frac{2}{3}$ ) length of the corolla; corolla yellow, 9.5–18 mm. long, 16–30 (average 22) mm. span, lobes 5 or sometimes 4, 7.5–12 mm. broad, variable in shape and apex (Fig. 2), without a longitudinal keel on the inner surface or very rarely having a reduced portion of one (Fig. 28); gynoecium normally with 2 placentas and 2 stigmas but occasionally 3 of each, ovules 10–19 per placenta. *Long-styled flower* with style slender, (3–) 4–6 mm. long; stigmas papillose, longer than broad, erect,  $\pm$  ovate and with recurved edges, 1–2.5 mm. long, held well above the anthers; anthers 1.6–2.2 mm. long, on short inconspicuous filaments (ca. 1 mm.). *Short-styled flower* with style thicker, 0.5–2 mm. long; stigmas papillose, broader than long, semi-erect to broadly-spreading, irregularly rounded, somewhat undulate, 1–1.8 mm. broad, held below the level of the anthers; anthers 2–3 mm. long, on noticeable filaments 2–3 mm. long. *Capsule* 5–13 mm. long, from a little  $<$  to slightly  $>$  the calyx-lobes, thickly chartaceous, sub-globular to broad-ellipsoid, the lower  $\frac{1}{3}$ – $\frac{1}{2}$  adnate to the calyx tube, dehiscing at the summit into 4 acute, slightly-recurved valves. *Seed* large, (1.5–) 1.7–2.6 (–3) mm. long, light cream-fawn to pale grey-brown to dark

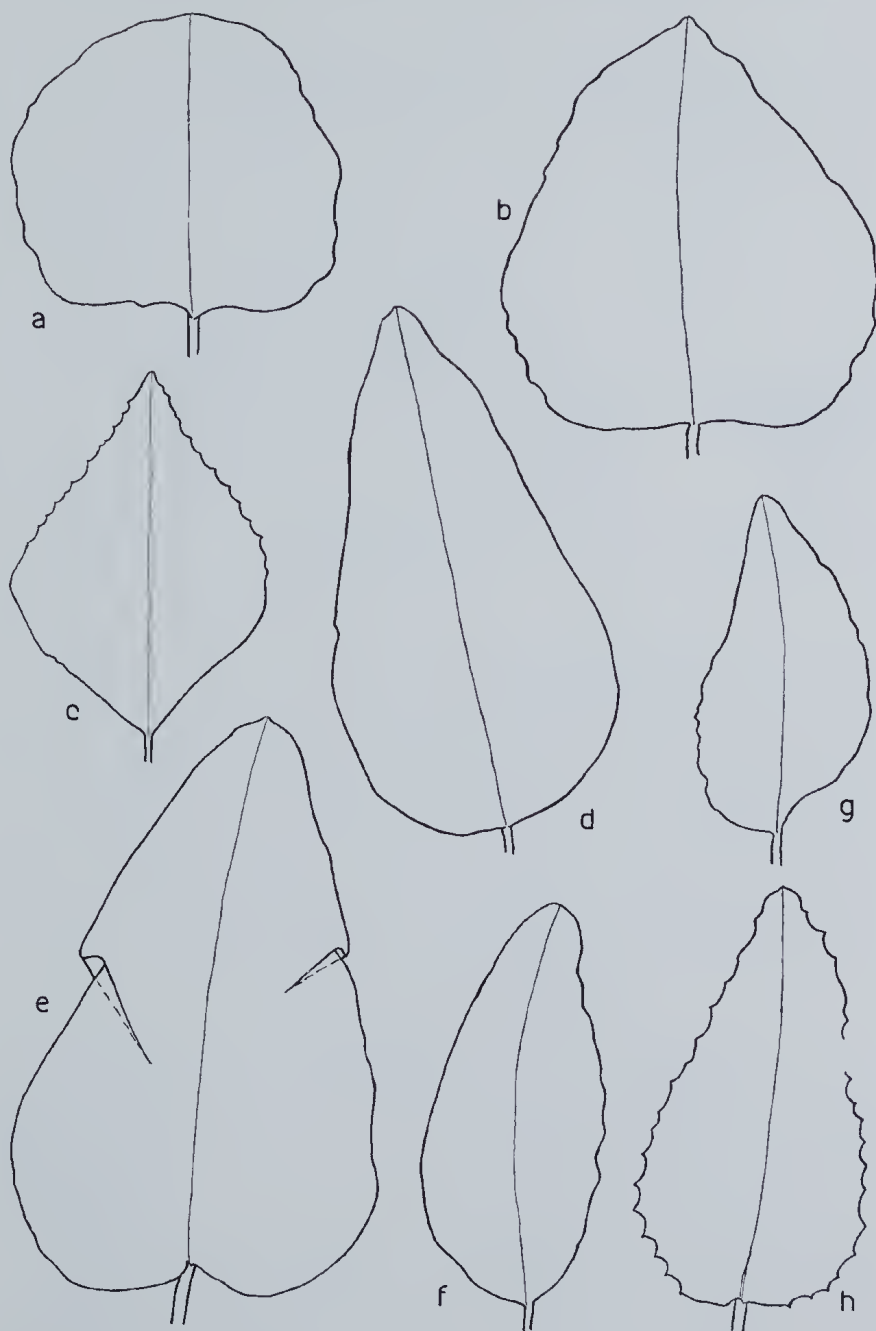


Fig. 26—*V. exaltata*, shape of radical leaves,  $\times \frac{3}{2}$ . a to f, Aston 1457. a to c, less usual shapes. g, MEL16339. h, Aston 1579.





Fig. 27—Heterostyly in *V. exaltata*. a, short-styled flower and stigma. b, long-styled flower and stigma. From Cranbourne, Victoria. Flowers x 6, stigmas x 14.



brown-grey-black, compressed broad-ellipsoid, double convex, with a conspicuous, whitish to translucent, circular, hollowed caruncle; surface with minute "jig-saw" patterns, smooth to slightly granular, and mostly also strongly and conspicuously tuberculate, or the tubercles sometimes reduced in size and number or very rarely completely lacking; tubercles terete, scattered to  $\pm$  densely arranged, up to 0.3 mm. long but usually half that length, each tubercle again minutely tuberculate at the extremity, its summit expanded.

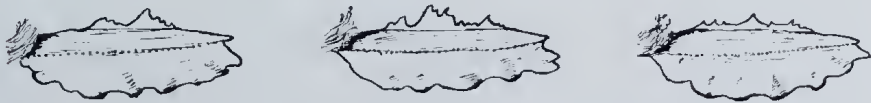


Fig. 28—*V. exaltata*. Abnormal, rudimentary keels on midlines of corolla-lobes. Cranbourne, Victoria.

#### DISTRIBUTION:

Near-coastal areas from about Gympie in south-east Queensland south through New South Wales and west to Cranbourne in Victoria, also in north-eastern Tasmania.

There are only two known localities for this species in Tasmania, St. Mary's and Scamander, but it very probably existed previously (and may still occur) near Georgetown. Hooker (1860, p. 272) when discussing *Villarsia* in Tasmania wrote "Gunn considers that . . . [there] . . . are two perfectly distinct species, and observes that one has floating leaves, and grows in lakes; the other has erect leaves, and grows in marshes only, near Georgetown, flowering a month earlier than the other". I would consider that Gunn's description of the Georgetown species applies very well to *V. exaltata*, including the reference to earlier flowering (whenever the two species concerned occur together under the same conditions). The species he describes first would be *V. reniformis* which is widespread in Tasmania.

#### HABITAT:

Sandy heathland; fresh-water aquatic in up to 2 feet (possibly a little more) of water in permanent swamps, or amphibian on low-lying areas subject to inundation in winter or to seepage, in summer surviving on dry or near-dry soil in such areas; open or semi-open situations receiving good sunlight, sometimes sheltered by denser, higher vegetation. The largest and most robust plants are found in water in open areas.

Some associated species recorded are *Banksia marginata*, *Leptospermum juniperinum*, *L. myrsinoides*, *Melaleuca ericifolia*, *M. squarrosa*, *Sprengelia incarnata*, *Epacris microphylla*, *Bauera rubioides*, *Gahnia clarkei*, *Restio tetraphyllus*, *Lepidosperma* sp., *Juncus* sp. sect. genuini, *Scirpus nodosus*, *Haloragis micrantha*, *Centella asiatica*, *Utricularia dichotoma*, *Drosera binata*, *Selaginella uliginosa*, and many small sedges.

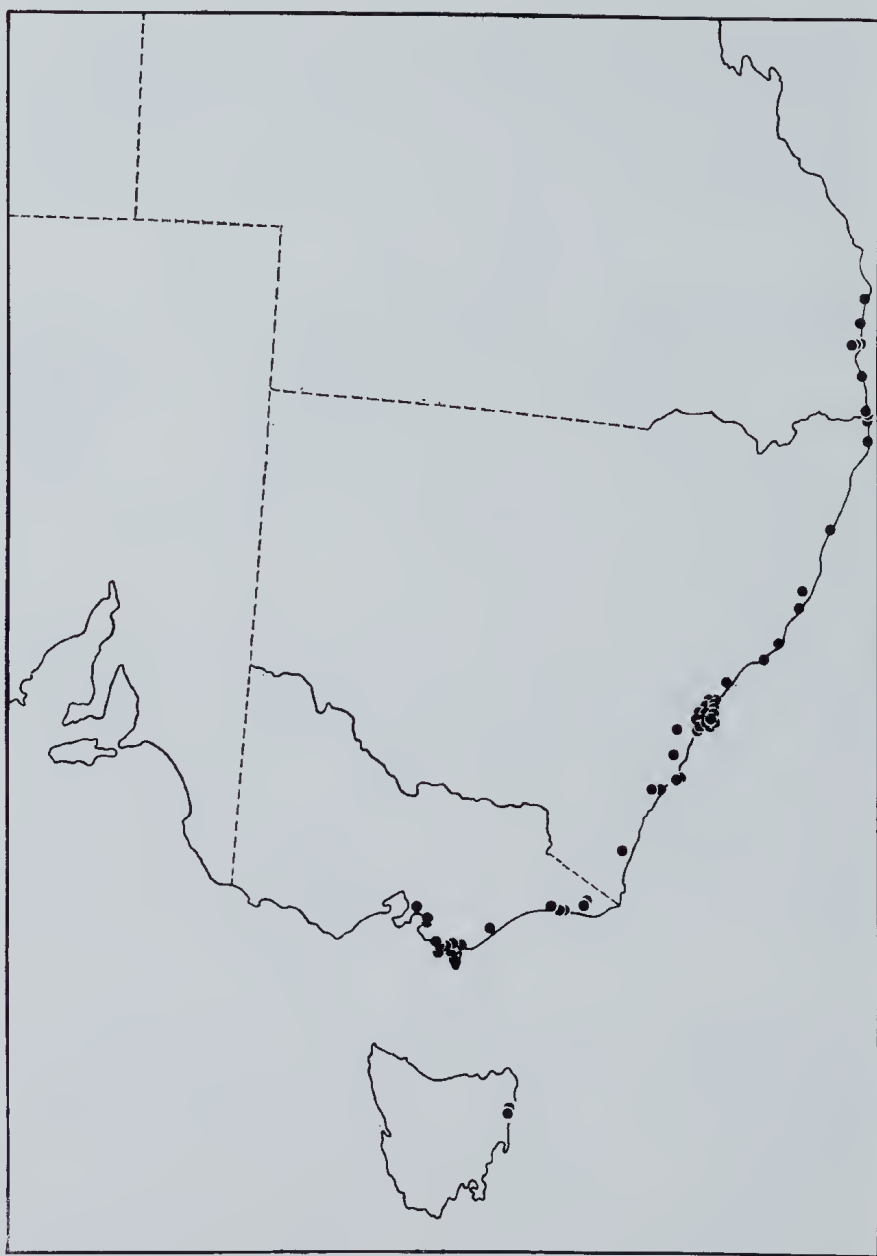


Fig. 29—*V. exaltata*, distribution map.

## FLOWERING TIME:

Fl. Aug.-May (in Victoria chiefly Oct.-Jan.), Fr. Oct.-May (in Victoria chiefly Nov.-March).

## TYPIFICATION:

The application of this name has created considerable confusion in the past. Mueller (1868, p. 139) and Bentham (1868, p. 376) both considered it synonymous with *V. reniformis* R. Br., which name they both retained. Since then, all floras of the eastern States have continued to accept this synonymy and have mostly used either *V. reniformis* or *V. exaltata* as the accepted name. However, these two entities are quite distinct, and are here redefined as separate species.

The confusion over the application of *V. exaltata* has undoubtedly arisen because of the lack of clarity in the type description of its basonym *Menyanthes exaltata* and the publication with it of an erroneous plate. This plate agrees more with *V. reniformis* than it does with *V. exaltata*, and is here excluded from the latter species.

The selection of lectotype material requires some explanation. It seemed logical to suspect that both Solander's manuscript and the material in the Banks Herbarium referred to by Sims in his description of *Menyanthes exaltata* would apply to material seen and gathered by Banks and Solander on Cook's Voyage of 1770. The furthest south they could have collected would be Botany Bay, New South Wales, for this was their first place of landing during the voyage northward up the east coast of the continent. Field work and examination of herbarium collections showed that the species of *Villarsia* occurring (quite commonly) at Botany Bay and northward is quite distinct from the more southern species which agrees well with the illustration published by Sims. It was therefore highly probable that the plate and the Banksian material were referable to different species. Accordingly, samples of leaves and seeds of Aston 1430 and 1431 (representing the two species in question) were forwarded to Dr. W. T. Stearn of the British Museum together with an explanatory sheet concerning points of similarity and difference. Dr. Stearn, replying by letter dated 2 Jan. 1967, wrote: "Comparison of Banks and Solander material with that sent shows closest agreement in leaf with Aston 1431 the leaf-blades being distinctly longer than broad, their surfaces matt, the veining on the lower surface not raised. The seeds are about 2 mm. long by 1.8 mm. broad, with a conspicuous pale caruncle at base and a distinctly tuberculate surface, though not so profusely tuberculate as in Aston 1431 and also much darker in colour . . . They are unlike those of Aston 1430." This comparison together with two seeds sent for my own examination, confirms that the Banksian material is conspecific with the entity here redefined as *V. exaltata*. In addition, examination of Solander's original manuscript showed that the material was collected at Sting Ray's Bay (now Botany Bay) between April 28-May 5, 1770, and this locality is verified by a note "New South Wales: Botany Bay. J.B.", i.e., Joseph Banks, on the back of the herbarium sheet.

Having determined the true nature of the Banksian material the question arose as to the lectotype of *Menyanthes exaltata* Soland. ex Sims. Dr. Stearn (letter 2 Jan. 1967) advised "Normally one would have accepted the plant figured by Sims. Here, however, there is a definite reference to 'Soland. MSS. et Herb. Banks', with both of which Sims was well-acquainted, and there is nothing in the diagnosis which could not have been taken from the Banks material. This is followed by the statement 'a native of New South Wales, where it was discovered by Sir Joseph Banks'. Thus it would seem logical as well as taxonomically convenient to typify *Menyanthes exaltata* by the material in Banks Herbarium (collected at Botany Bay) which Sims cites. My colleagues Mr. J. E. Dandy and Mr. R. Ross . . . independently made the same choice when confronted with the evidence . . . Botany Bay, New South Wales, then becomes the restricted type-locality". I am in absolute agreement with this decision, and the Banksian material (BM) here referred to now becomes the lectotype of the species. A Banks and Solander duplicate collection (NSW90511) obtained by the National Herbarium of New South Wales from the British Museum becomes an isotype. It agrees well with a photo of the lectotype forwarded to Melbourne.

#### DISCUSSION:

A very distinctive species readily separated from *V. reniformis*, the only species sympatric with it, by the erect, thick-textured, matt-surfaced, typically ovate foliage, the heterostylous flowers with smaller span, the capsule rather more globular and adnate below to the calyx-tube, and the larger, strongly-tuberculate seeds. In almost all situations the species can be distinguished by foliage alone. At Cranbourne, where both species occur side by side in a swamp, *V. exaltata* was found flowering a month earlier than *V. reniformis*, but I have insufficient evidence to determine if this is generally so. It is likely that variation in water level partly controls flowering time. (See also under distribution.)

*V. exaltata* seems closely related to *V. lasiosperma* of south-western Australia. The two species are virtually indistinguishable vegetatively, and both have large tuberculate seeds although the tubercles are of different types. The corollas of *V. lasiosperma*, although white, possess a longitudinal keel or wing on the inner surface of each lobe, a feature suggested in some abnormal flowers of *V. exaltata* (Fig. 28) but not found in other species.

No attempt has been made to ascertain the breeding system associated with the heterostylous nature of this species, but seeds have been forwarded to Dr. Robert Ornduff, University of California, Berkeley, U.S.A., who is studying this subject in Menyanthaceae. In the field both style types appear functionally bisexual, and set apparently viable seed in equal quantities. There is no noticeable distinction between flower, capsule, and seed sizes of short-styled and long-styled plants. The only exception occurred in a small population near Tarwin Lower (Aston 1577) where capsule length varied from 5–9 mm. on one plant



to 9–13 mm. on another. As flowering was completed it was not possible to determine if this difference was associated with different style types, but habitats appeared identical. Ornduff (1966) is topical to this aspect.

#### SPECIMENS EXAMINED:

QUEENSLAND—Durval (the present Toorbul), *Leichhardt*, 25.9.1843 (NSW90512); (Sd) Maroochie Swamps, *F. M. Bailey*, Oct. 1874 (BRIO61778); Queensland, *Eaves*, 1874 (MEL16331); (Sd) Wellington Point, *J. Wedd*, Nov. 1891 (BRIO61777) "This plant seldom has reniform leaves"; (Sd) Lake Cootharaba, *J. Keys*, 1911 (BRIO61776); Coolangatta, *C. T. White*, Sept. 1912 (NSW90513) "Very common in swamps"; Swamps at back of Coolangatta, *C. T. White*, Sept. 1912 (BRIO61774); (Sd) Bribie Island, *W. D. Francis*, Nov. 1919 (BRIO61772); Elimbah, *C. T. White* 3248, 12.9.1926 (BRIO61775).

NEW SOUTH WALES—(Sd) Hastings River, *Dr. Beckler* (MEL16330); (Sd) Manly swamps, *W. Woolls* (MEL16329) "leaves not floating"; Manly beach, *W. Woolls* (MEL16333); Port Jackson, Manly, *E. Bêche*, 30.11.1881 (NSW90524); Waterloo marshes, Sydney, Coll.? *T. Whiteleggc*, Dec. 1884 (MEL16328) "Two small packets containing flowers only, one labelled 'short style and long stamens', the other 'Long style with short stamens. The lobes of the stigma are longer than the short style one'"; (Sd) Broger's Creek, *W. Bauerlen* 24, May 1886 (MEL16327); (Sd) Richmond River, N.S.W., 1887 (MEL16326); Kogarah, *T. S. Cumfield*, Oct. 1893 (NSW90528); (Sd) Wyong, *J. L. Boorman*, Jan. 1903 (NSW90521); (Sd) Byron Bay, *J. H. Maiden & J. L. Boorman*, Nov. 1903 (NSW90515); Coffs Harbour, *J. L. Boorman*, May 1909 (NSW90517) "A very common plant found everywhere on the coast in permanently wet places. Growing from less than 1–4 ft. high"; (Sd) Table Mountain near Milton, *R. H. Cambage* 4039, 27.12.1913 (NSW90534); Botany Swamps, *L. Abrahams*, April 1914 (NSW90529); Johns River, *J. L. Boorman*, Nov. 1915 (NSW90518); Johns River, *J. L. Boorman*, Dec. 1915 (SYD); La Perouse, *H. M. Rupp*, April 1916 (MELU); (Sd) Wyong, *J. L. Boorman*, Nov. 1916 (NSW90522); (Sd) Narrabeen, *H. M. Rupp*, Jan. 1917 (MELU); R.A.N. College, Jervis Bay, *F. A. Rodway*, Jan. 1918 (NSW91012); Bowen Island, Jervis Bay, *F. A. Rodway*, Nov. 1919 (NSW91015); (Sd) Bowen Island, Jervis Bay, *F. A. Rodway*, Dec. 1925 (NSW91014); (Sd) Botany Bay District, *O. D. Evans*, 8.12.1925 (SYD) "in a swamp" "erect" "flower yellow"; (Sd) Dee Why, *O. D. Evans*, 23.2.1926 (SYD) "margin of swamp" "flower yellow"; Fitzroy Falls, S. Coast, N.S.W., *F. A. Rodway* 233, 30.11.1930 (NSW91013); Byron Bay, *C. T. White* 10430, 24.8.1936 (BRIO61773) "Fairly common on marshy ground. Rather a succulent plant with very brittle stems. Flowering stalks erect, branching, about 3 ft. high. Flowers yellow"; Cape Solander, *L. A. S. Johnson*, 20.10.1945, (NSW90530) "Common in wet sedge-swamp" "(Swamp) about 1' deep" "Per. herb, 60 cm., hydrophyte, leaves sub-aerial" "Fl. yellow"; (Sd) Narrabeen, *H. Salasoo* 1027, 4.1.1953 (NSW90523); Centennial Park, *G. Chippendale*, 19.8.1953 (NSW90526) "in swamp"; (Sd) North of Boote Boote, *L. A. S. Johnson*, 13.10.1953 (NSW90519) "Petals yellow, fringed. Common on edge of Cladium swamp"; Byron Bay, per *Shire Council*, Sept. 1954 (NSW90516) "reaching pest proportions in low lying swampy heath land"; (Sd) Maroubra, *N. C. Ford*, Nov. 1954 (NSW90527) "among thick sedge vegetation in hind-dune quaking bog. Fl. yellow"; (Sd) Carrington Falls, *E. F. Constable*, 22.1.1955 (NSW30798) "Erect slender herb, 2–3', fls. yellow. Scarce. Sandstone. 1850"; Pigeon House Range (between Braidwood and Jervis Bay), *E. Gauba* 008176, 21.11.1958 (CBG); (Sd) Little Bay, *E. F. Constable*, 22.11.1960 (NSW53341) "Erect herb 12–18", flowers yellow. Localised to one area. Swampy ground. Sandstone. Altitude 50 ft."; (Sd) Picton Lakes, Thirlmere, *E. J. McBarron* 7119, 21.4.1962 (NSW90533) "Yellow flowered—fringe of lake rooted in water"; (Sd) Picton Lakes, *D. Blaxell*, 13.12.1962 (NSW90532) "Edge of lake—damp soil" "Sandy" "Height 5'"; (Sd) Duranbah, Tweed River, *H. S. McKee* 11655, 6.10.1964 (NSW90514) "recently cleared damp sandy ground" "erect; leaves dark glossy green above, light glossy green below; leaf bases purple; flowers yellow"; Nelson Bay, *G. M. Lithgow* 96, 15.2.1965



(NSW90520) "Common in swampy areas" "taken from swamp margin"; Tabbigai, Kurnell Peninsula, *B. G. Briggs*, 13.8.1965 (NSW90531) "Flowers golden yellow. Bases of stems and petioles purplish. Beside pool in sedge swamp among dunes"; (Sd) Kurnell, *B. G. Briggs and L. A. S. Johnson*, 13.11.1965 (NSW90508) "rooted in wet sand near deep swamp; at edge of scrub adjoining bare sand. Short-styled flowers". Also same collection (NSW90509) "Long-styled flowers (long and short styles apparently  $\pm$  similar in numbers in the stand)". Also (NSW90510) "Long-styled flowers"; Picton Lakes, Thirlmere, *L. A. S. Johnson & B. G. Briggs*, 21.11.1965 (NSW90507) "rooted in sand near water's edge and in shallow water. Flowers yellow" "alt. 1000 ft."; Myall Lakes, near Bulledelah, *J. Jacobs*, 2.10.1967 (MEL26099) "Melaleuca quinquenervia swamp forest"; Wingecarribee Swamp, near Bowral, *L. A. S. Johnson*, 18.11.1967 (NSW97481) "Edge of peat bog only, in ca. 15 cm. water".

VICTORIA—Snowy River, *F. Mueller*, March 1854 (MEL16337); (Sd) Australia Felix, *F. Mueller*, Jan. 1855 (MEL16335); (Sd) Austral. Alps, *F. Mueller*, Jan. 1855 (MEL16338) locality considered incorrect—probably lower Snowy River; (Sd) Newmerella, *C. H. Grove*, 12.2.1906 (MEL16334) "ovate-leaved form" "swampy ground"; Wilsons Promotory, high plain, *Audas and St. John*, 11.11.1908 (MEL16336); Reedy Creek, 3m. E. of Cann River, *N. A. Wakefield* 2869 (MEL25464); Marlo to Cape Conran road, *N. A. Wakefield* 3785 (MEL25463); Cranbourne Swamp, *E. J. Sonnenberg*, 16.10.1936 (MELU); Lang Lang, coll.? 23.11.1962 (MEL16339-41); Port Welshpool swamp, *D. H. Ashton*, Jan. 1963 (MELU); Cranbourne, *H. I. Aston* 1236, 27.10.1964 (MEL16343-4); (Sd) Cranbourne, *H. I. Aston* 1328A, 19.1.1965 (MEL16342); (Sd) Cranbourne, *H. I. Aston* 1391, 17.11.1965 (MEL16356-9); (Sd) 7 miles S. of Lang Lang, *H. I. Aston* 1431, 10.12.1965 (MEL16345-7); (Sd) Lang Lang, *H. I. Aston* 1432, 10.12.1965 (MEL16360-2); Reedy Creek, 4.5 miles S. of Cann River, *H. I. Aston* 1455, 11.1.1966 (MEL16348); (Sd) 9 miles east of Marlo, *H. I. Aston* 1457, 12.1.1966, (MEL16349-52); Stradbroke, *H. I. Aston* 1459, 13.1.1966 (MEL16363); (Sd) 4 miles S.S.E. of Foster, *H. I. Aston* 1461, 14.1.1966 (MEL16353-5); (Sd) Tarwin Lower, *H. I. Aston* 1577, 2.3.1967 (MEL20425-6); (Sd) 6 miles S.E. of Tarwin Lower, *H. I. Aston* 1578, 2.3.1967 (MEL20427-9); (Sd) Cape Liptrap, *H. I. Aston* 1579, 2.3.1967 (MEL20430-1); 7 miles S.S.W. of Fish Creek, *H. I. Aston* 1580, 2.3.1967 (MEL20432).

TASMANIA—St. Mary's, *L. Rodway* (HOB) "on land"; (Sd) One mile north of Scamander, *T. E. Burns*, 16.5.1966, collected alive and grown on at Melbourne from where material pressed (MEL20447-9).

# 11. *Villarsia reniformis* R. Br. *Prodr. Flor. Nov. Holl.* 457 (April 1810).

*Menyanthes sarmentosa* Sims in *Curtis's bot. Mag.* 1328 (Oct. 1810).

Stoloniferous perennial, conspicuously red-dotted on submerged portions, the culm erect or semi-erect, the radical leaves typically floating. *Stolons* usually strongly developed when plants aquatic in deeper, near-permanent waters and then 15 in.–6 ft. long, up to 1.5 cm. diam., rooting and shooting at intervals of several–40 cm. along their length, several rising from the base and sometimes also one from the axil of the lowest cauline leaf when this is submerged; stolons usually not produced on plants occurring where waters are shallow and temporary. *Radical leaves* typically floating (sometimes erect) on plants in deeper waters, but normally erect on plants produced by shallow temporary water, on petioles 3–27 in. long; blades reniform, orbicular, or broad-ovate, mostly about as broad as long or slightly longer than broad, but varying from length equal  $\frac{2}{3}$  to  $\frac{4}{3}$  of breadth, length (3–) 4–8 (–10 or rarely 12) cm., apex obtuse to rounded or rounded-emarginate, base cordate, the lobes

mostly well-pronounced and up to  $\frac{1}{3}$  ( $-\frac{1}{2}$ ) of the leaf length, rarely as little as  $\frac{1}{12}$  of the leaf length or the base  $\pm$  truncate, sinus broad to extremely narrow or the lobes sometimes overlapping, edge entire to slightly (rarely strongly) crenate-dentate, texture mostly moderately thick; floating blades strongly dorsi-ventral, upper surface deep green and glossy, the lower pale cream-green and strongly dotted, often coloured with maroon-red, the veins clearly visible; erect blades as for the floating or often less dorsi-ventral with upper surface paler and non-glossy, the lower greener with dots inconspicuous to almost lacking. Culms solitary or few, 17 in.-3 ft. 8 in. high, standing erect above the leaves or in deeper water semi-erect and half-reclining amongst surface vegetation; cauline leaves 1-several, solitary at each node, lowest leaf

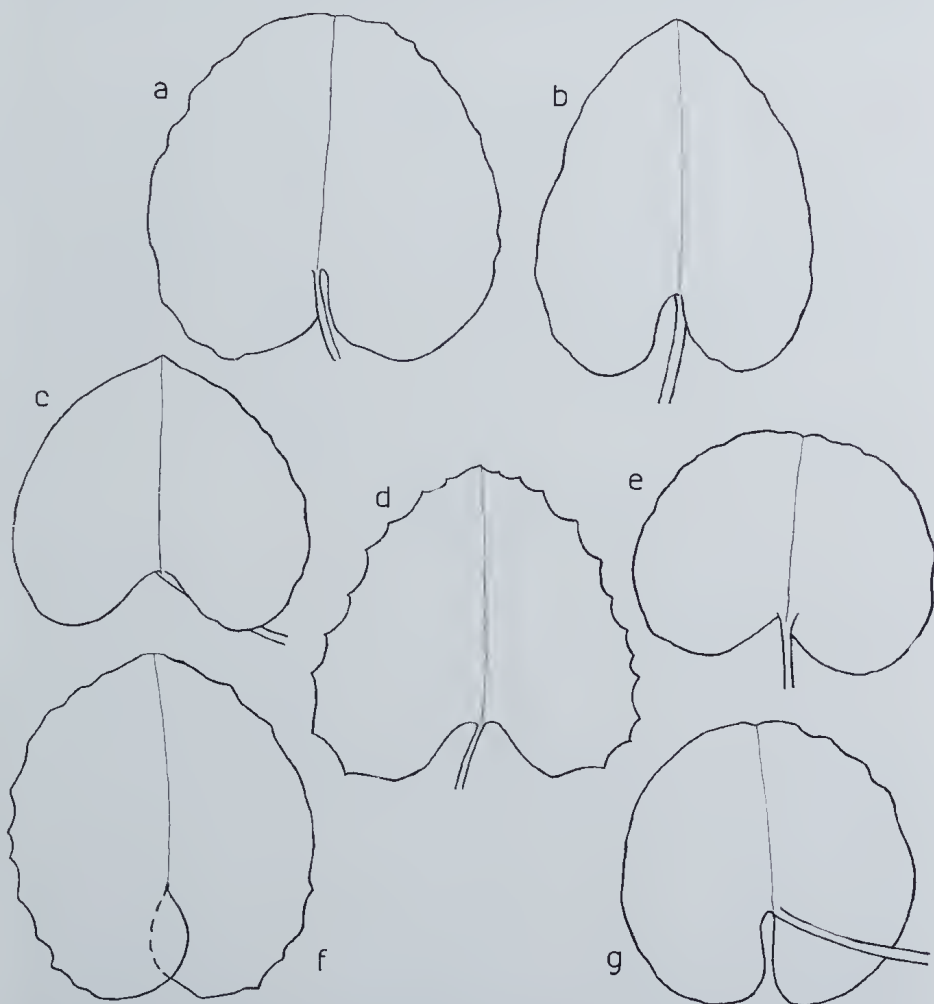


Fig. 30—*V. reniformis*, shape of radical leaves,  $\times \frac{2}{3}$ . a to d, Aston 1428. e, Aston 1581. f, Aston 21.10.1960. g, Aston 1393.

(often absent from herbarium specimens) arising from near the culm base to above half the culm height, on larger plants the lowest 1–2 cauline leaves radical-like, on petioles from very short to 20 in. long. *Inflorescence* an open, many-flowered panicle, usually confined to near the summit of the culm; final bracts ovate, acute,  $\pm$  3–5 mm. long; pedicels (of mature capsules) (7–) 10–25 (–37) mm. long, remaining erect. *Flowers* homostylous; calyx-lobes 6.5–10 (–11) mm. long, lanceolate, acute,  $\frac{2}{5}$ – $\frac{3}{5}$  length of the corolla; corolla yellow, 12–23 mm. long, 19–43 (average 32.3) mm. span, lobes 5 or sometimes 4 or 6, 7–14 mm. broad, variable in shape and apex (Fig. 2), without a longitudinal keel; gynoecium with 2 placentas, ovules 41–88 per placenta, style 0.5–3 mm. long, stigmas 2, papillose, rather variable in shape and length-breadth ratio, 0.5–1.5 (–2.5) mm. long, held about level with the anthers; anthers 3–4 (–5) mm. long, on short filaments 1–2 mm. long. *Capsule* 7–11.5 mm. long, from a little < to > calyx-lobes, and sometimes exerted by as much as  $\frac{1}{4}$  the length of the calyx-lobes, thickly chartaceous, ovoid-ellipsoid, adnate to the calyx-tube only at the very base, dehiscing at the summit into 4 acute, somewhat-recurved valves. *Seed* (0.7–) 1–1.5 (–1.9) mm. long, pale cream-fawn-yellow to light reddish-fawn or reddish-brown, sometimes greyish-fawn but never dark grey or black, compressed broad-ellipsoid to almost compressed globular, double convex or thickened in the middle and with a slight intra-marginal depression, sometimes almost flat across the sides, point of attachment without a conspicuous caruncle; surface with minute “jig-saw” patterns, smooth to slightly granular, mostly dull but at times glossy, without tubercles.

#### DISTRIBUTION:

South-east South Australia and Kangaroo Island, Tasmania, southern Victoria, and south-east New South Wales.

Within South Australia the distribution of this species is in part uncertain. It is the common *Villarsia* of the south-east, around the Mt. Gambier-Kingston-Naracoorte region and might be located in future as far north as Bordertown if a series of wet seasons provided suitable swamps. A few collections from Kangaroo Island also agree with this species, although none of those seen by the writer shows the typical robust, stoloniferous nature characteristic of the plants of the south-east and elsewhere, while one of them (Hj. Eichler 18466) has seeds which by their slightly granular nature suggest affinity with *V. umbricola* var. *umbricola*. There are several mainland specimens from the vicinity of Adelaide-Macclesfield-Myponga which could possibly represent *V. reniformis* but which are either incomplete or limited in demonstrating essential characters. They might be referable instead to *V. umbricola* var. *umbricola*, but positive identification cannot be made. *V. reniformis* should be considered as only doubtfully present in the area concerned. Dr. Eichler of the State Herbarium of South Australia informs me that he has never seen *V. reniformis* in the Mt. Lofty Ranges or on the Fleurieu Peninsula. Further work there and on Kangaroo Island would be desirable.

Tilba, The Clyde, Bombala, and near Bowral, in south-east New South Wales, are the only four definite localities for that State. There is a possibility that the species may have occurred in the Sydney district, but this rests only on two doubtful specimens. An early collection of Woolls from Parramatta has foliage only and its identity remains suspect, while a specimen labelled Kogarah 1893 is of doubtful locality due to its admixture with another collection. Specimens collected in 1805 by G. Caley and labelled New South Wales would almost certainly have come from Tasmania.

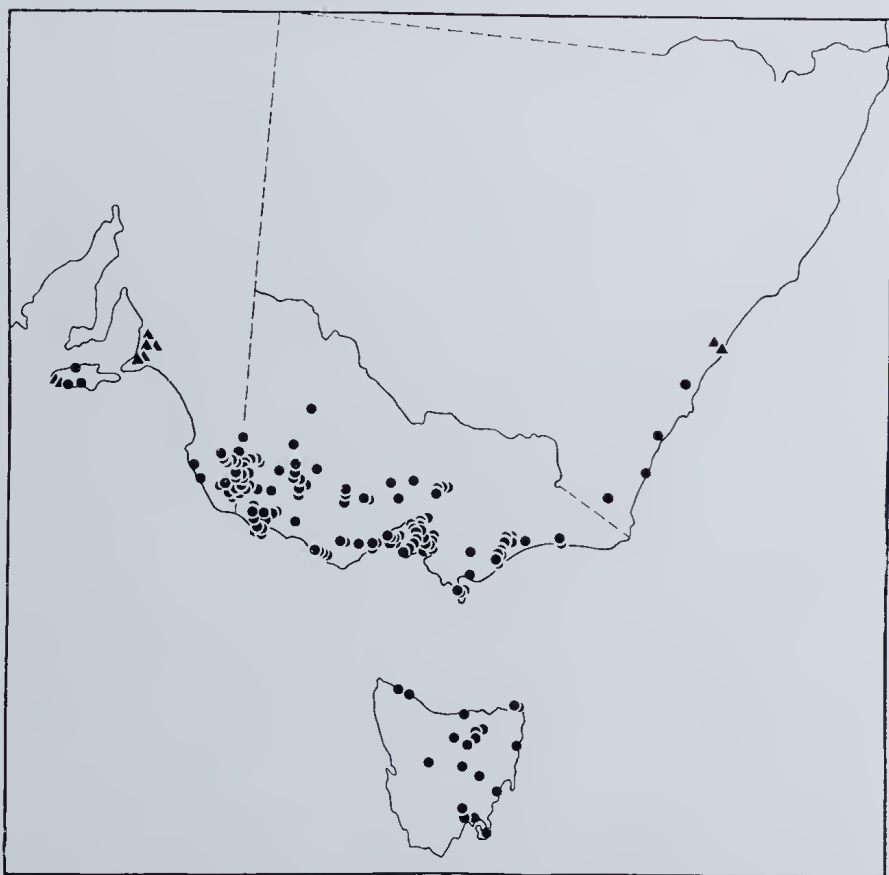


Fig. 31—*V. reniformis*, distribution map. ● Definite records. ▲ Doubtful records.

#### HABITAT:

Swamps and depressions on varied soils, often sandy or peaty; aquatic in permanent freshwaters up to 2 feet deep or probably more, or found in shallow seasonal waters, dying back when stranded by falling levels; open or semi-open situations receiving good sunlight. The largest and most robust plants are found in deep water in open areas.



Some associated species recorded are *Leptospermum juniperinum*, *L. lanigerum*, *Melaleuca ericifolia*, *M. squamea*, *Acacia verticillata*, *Clodium glomeratum*, *Gahnia clarkei*, *Eleocharis sphacelata*, *E. acuta*, *Restio tetraphyllus*, *Lepidosperma* sp., *Lepyrodia* sp., *Juncus maritimus*, *Juncus* sp. sect. *genuinii*, *Amphibromus recurvatus*, *Myriophyllum propinquum*, *M. muelleri*, *Triglochin procera*, *T. striata*, *Potamogeton tricarinatus*, *P. ochreateus*, *Scirpus fluitans*, *Claytonia australasica*, *Utricularia flexuosa*, *Ranunculus rivularis*, *Haloragis brownii*, *Selliera radicans*, *Samolus repens*, *Crassula helmsii*, and small sedges.

#### FLOWERING TIME:

Fl. Oct.-Jan. (-March), Fr. (Oct.-) Nov.-March.

#### TYPIFICATION:

When investigating the confused typification of *V. exaltata* (q.v.) and *V. reniformis* selected specimens were forwarded to the British Museum for comparison with type material. Dr. Stearn, in a letter dated 2 Jan. 1967, wrote: "Brown's specimen from Port Dalrymple collected in 1804 lacks flowers and the capsules have disintegrated but the leaf-blades are cordate, with a marked difference in colour between the upper and lower surfaces, the lower are conspicuously dotted and with evident veining as in Aston 1428; the largest is about 3 cm. long and broad. A better specimen written up by Brown as *Villarsia reniformis* collected at Port Dalrymple by Paterson agrees closely in size, etc., of leaf with Aston 1428. The seeds of this are smooth and glossy, about 1.2-1.4 mm. long". This comparison adequately verifies the true nature of *V. reniformis*, and as Brown's own collection is incomplete the Paterson collection is now chosen as lectotype. A photograph of this sheet was forwarded to Melbourne.

As *Menyanthes sarmentosa* Sims was based on cultivated material the plate itself must be taken as the type. This agrees well with *V. reniformis*, and in addition Sims notes in his description "... the remarkable runners, several feet in length, putting out leaves and roots, at intervals of about a foot and a half ...", a feature of the aquatic form of this species.

#### DISCUSSION:

This species has long been confused with *V. exaltata* but in its typical form with glossy, reniform-orbicular, cordate, floating leaves and conspicuous stolons it is readily distinguished. See also under *V. exaltata* discussion and typification. For distinctions between *V. reniformis* and *V. umbricola* see under the latter species.

There is a general uniformity of seed size amongst the plants of any one population, the maximum variation found being 0.5 mm. On the other hand there is often a noticeable variation in seed size between the plants of different populations, even when these populations occur within the same district. For example in south-western Victoria two separate swamps in the Edenhope-Langkoop area had seed sizes of



1.5–1.7 (av. 1.57) mm. for 42 seeds measured and 1.5–1.7 (av. 1.63) mm. for 56 seeds measured. At both places many more seeds noted by eye were similarly large in size. In contrast, another population in the Edenhope district, with 39 seeds measured had small seeds 0.9–1.2 (av. 1.08) mm. Other small-seeded populations at Heywood in south-western Victoria (81 seeds, 0.7–1 mm., av. 0.91) and at Dalmore south-east of Melbourne (42 seeds, 0.7–1 mm., av. 0.88) again illustrate how the variation in seed size between different populations is not related to geographical distribution. It could indicate a greater efficiency of vegetative spread over sexual reproduction within each small habitat zone, a feature which would be suspected from the stoloniferous habit of the species.

Flowers of *V. reniformis* are quite bright yellow in colour. The only exception found was in a swamp in western Victoria where some plants with pale yellow corollas were scattered amongst the population. Most plants in the swamp were normally coloured.

#### SPECIMENS EXAMINED:

SOUTH AUSTRALIA—Yallum, ca. 15 km. W. of Penola, Herb. *R. Tate* 106, Nov.? (AD966100364); Harriet River, Kangaroo Is., *T. G. B. Osborn*, 25.11.1923 (AD966100362); Middle River, Kangaroo Is., *R. L. Crocker*, Dec. 1940 (ADW); Near Kelly Hill, Kangaroo Is., *Hj. Eichler* 15271, 7.11.1958 (AD96301032); 10 km. E. of Penola, *P. Wilson* 1293, 16.11.1959 (AD96022051); Bool Lagoon—Lucindale road, *D. Hunt* 260, 21.10.1961 (AD96151148); W. of Bool Lagoon, *D. N. Kraehenbuehl* 1037, 12.10.1963 (AD96417201); 30 km. S.W. of Naracoorte, *D. Hunt* 1738, 24.12.1963 (AD96405213); (Sd) Kelly Hill Caves Reserve, Kangaroo Is., *Hj. Eichler* 18466, 23.12.1965 (AD966110340; MEL25436); (Sd) Between Joanna and Struan, *M. A. Fagg* 119, 28.1.1966 (AD966110322); (Sd) 4 miles S.E. of Tarpeena, *H. I. Aston* 1517, 15.12.1966 (MEL20459-60); 6 miles S.E. of Tarpeena, *H. I. Aston* 1518, 15.12.1966 (MEL20458); (Sd) 6 miles W. of Kalangadoo, *H. I. Aston* 1519, 15.12.1966 (MEL20455-7); (Sd) 7 miles E.S.E. of Beachport, *H. I. Aston* 1524, 16.12.1966 (MEL20454); (Sd) 12 miles S.E. of Robe, *H. I. Aston* 1525, 16.12.1966 (MEL20453); (Sd) 3.5 miles E. of Hynam, *H. I. Aston* 1533, 20.12.1966 (MEL20452); (Sd) 8 miles E. of Struan, *H. I. Aston* 1534, 20.12.1966 (MEL20451); (Sd) 7 miles N.E. of Penola, *H. I. Aston* 1535, 20.12.1966 (MEL20450 and 25437); (Sd) 10 km. S.E. of Mt. Burr township, *I. B. Wilson* 715, 11.3.1967 (MEL26379; AD96719058) "in shallow waters of swamp interspersed with *Gahnia clarkei* clumps"; Larrikin Lagoon, Kangaroo Island, *J. B. Cleland*, 28.10.1967 (AD96748176).

NEW SOUTH WALES—(Sd) Tilba, N.S.W. *Reader*, Dec. 1879 (MEL16290); The Clyde, *W. Bauerlen* 78, Oct. 1884 (MEL16292); Bombala, *W. Bauerlen* 279, Dec. 1886 (MEL26384); Wingecarribee Swamp, near Bowral, *L. A. S. Johnson*, 18.11.1967 (NSW97482) "In water ca. 20 cm. deep on peaty bottom. Leaf-blades emerging, not floating".

VICTORIA—Near Melbourne, coll.?, 20.9.1856 (MEL16268) "Marshy ground and waterholes" "Common"; Mount McIvor and McIvor Creek, *F. Mueller*, Nov. (MEL16267); Ballarat, *Bacchus* (MEL16270); (Sd) Near Mt. Gellibrand, *F. Mueller*, Mar. 1875 (MEL16266); Barwon, Queenscliff Road, *J. B. Wilson*, 2.12.1882 and 1883 (MEL16271); Port Phillip, *Reader*, Dec. 1884 (MEL16272); Lilydale, *A. H. S. Lucas*, Nov. 1885 (NSW90539); (Sd) Near Lake King, *C. H. Grove*, 1887 (MEL16318; MEL27196); Wimmera, *Davis*, 1890 (MEL16259 and 16317); Upper Yarra, *C. Walter*, Dec. 1896 (NSW90540); (Sd) Frankston, *C. Walter*, Dec. 1897 (NSW90537); Hawkesdale, *H. B. Williamson*, Oct. 1898 (NSW90536); Dromana, *J. H. Findlay*, 12.12.1898 (MEL 16325); Brim, *W. S. Macpherson*, 1898 (MEL16262) "springs lagoons"; (Sd) Dandenong,

W. R. Baker, 20.10.1899 (MEL16277); (Sd) Dandenong, W. R. Baker, 1.12.1899 (MEL16276); Beaconsfield, W. R. Baker, 24.10.1901 (MEL16324); Springvale, C. S. Sutton, Nov. 1901 (MEL16269); (Sd) Springvale, G. Weindorfer, Dec. 1901 (MEL16263); (Sd) Cheltenham, K. Cowle (MEL16257-8); (Sd) Vermont, W. R. Baker, 8.12.1902 (MEL16273); (Sd) Pakenham, W. R. Baker, 26.11.1904 (MEL16279); (Sd) Mornington Junction 10.11.1905 and Officer 30.11.1905 (mixed collection), W. R. Baker (MEL16274-5); Wilsons Promontory, A. D. Hardy, Dec. 1905 (MEL16265); Frankston, W. R. Baker, 14.12.1905 (MEL16323); (Sd) Newmerella, C. H. Grove, 12.2.1906 (MEL16278) "floating form"; (Sd) Beaumaris, A. J. Tadjell, Mar. 1908 (MEL16264); (Sd) Dalmore, A. Meebold 21771, 12.2.1936 (NSW90538); Cranbourne Swamp, Dr. Patton, 13.11.1938 (MELU); Gorae West, A. C. Beaglehole 7328, Nov. 1946 (HERB A.C.B.); Moora Moora Reservoir, Grampians, T. & J. Whaite 1513, 26.10.1953 (NSW90535) "aquatic herb, radical leaves, in swamp"; Beaufort, F. Swindley 41, 9.12.1959 (MEL16255-6) "Growing both on wet land near the lake, and in the water. Petals yellow" "Leaves, of plant in water, floating"; Near Condah Swamp, A. C. Beaglehole 7050 and H. I. Aston, 21.10.1960 (HERB. A.C.B.; MEL16251-2); 5 miles S.W. of Casterton, H. I. Aston 770, 23.10.1960 (MEL25444; AD96110056); (Sd) N. of Wannon Bridge, Grampians, D. E. Symon 1757, 1.11.1961 (ADW25084); (Sd) Victoria Valley, Grampians, D. E. Symon 1808, 4.11.1961 (ADW25082) "Leaves floating"; (Sd) 4 miles S.W. of Edenhope, F. Swindley 1187, 30.11.1962 (MEL255) "Small swamp"; Beaconsfield, H. I. Aston 1228, 27.10.1964 (MEL16250); 4 miles N.E. of Morwell, E. F. Constable 5314, 28.10.1964 (NSW78582) "swampy ground" "flowers yellow" "Very localised"; (Sd) 4½ miles S.S.E. of Yea, H. I. Aston 1308, 7.12.1964 (MEL16253-4); 8 miles W. of Alexandra, H. I. Aston 1319, 8.12.1964 (MEL16245-6); (Sd) Cranbourne, H. I. Aston 1328, 19.1.1965 (MEL16247-9); (Sd) 20 miles west of Bairnsdale, H. I. Aston 1344, 29.1.1965 (MEL16244); (Sd) 3 miles E. of Skipton, H. I. Aston 1393, 22.11.1965 (MEL16212-3); (Sd) 9 miles S.W. of Stawell, H. I. Aston 1410, 23.11.1965 (MEL16214); (Sd) Moora Moora Reservoir, Grampians, H. I. Aston 1414, 24.11.1965 (MEL16215); (Sd) 16 miles W. of Casterton, H. I. Aston 1418, 25.11.1965 (MEL16216); (Sd) 4.5 miles N.N.W. of Dunkeld, H. I. Aston 1424, 26.11.1965 (MEL16233-4); (Sd) 15 miles N.N.E. of Cavendish, H. I. Aston 1426, 26.11.1965 (MEL16217-9); (Sd) 12.5 miles S. of Cherrypool, H. I. Aston 1428, 26.11.1965 (MEL16220-2); (Sd) Cherrypool, H. I. Aston 1430, 26.11.1965 (MEL16235-6); (Sd) Lang Lang, H. I. Aston 1433, 10.12.1965 (MEL16226-7); (Sd) Peterborough, H. I. Aston 1434, 13.12.1965 (MEL16223-5); (Sd) 4.5 miles W.N.W. of Gorae West, H. I. Aston 1437, 14.12.1965 (MEL16228); (Sd) Drik Drik, H. I. Aston 1440 and A. C. Beaglehole 6782, 14.12.1965 (MEL16229); (Sd) Heywood, H. I. Aston 1444, 15.12.1965 (MEL16230); (Sd) 6.6 miles W. of Dergholm, H. I. Aston 1446, 15.12.1965 (MEL16231); (Sd) 7.2 miles N.W. of Dergholm, H. I. Aston 1447, 15.12.1965 (MEL16232); (Sd) 4 miles S.E. of Edenhope, H. I. Aston 1448, 16.12.1965 (MEL16237-9); (Sd) 6 miles W.S.W. of Horsham, H. I. Aston 1452, 16.12.1965 (MEL16240-1); (Sd) 4 miles S.S.W. of Stradbroke, H. I. Aston 1460, 13.1.1966 (MEL16242-3); (Sd) Penola to Dergholm road 1 km. on Victorian side of border, M. A. Fagg 118, 28.1.1966 (AD966100290; MEL25438); Port Campbell, I. Stone, 29.10.1966 (MEL20463-4); St. Leonards, H. I. Aston 1473, 2.11.1966 (MEL20468-71); 3 miles S.S.W. of Rosebud, H. I. Aston 1481, 7.11.1966 (MEL20472); (Sd) 4 miles W. of Portland, H. I. Aston 1513, 13.12.1966 (MEL20461); (Sd) Drysdale, A. Gibbon, 15-20.12.1966 (MEL20473-4); (Sd) Darby River, Wilsons Promontory, J. H. Willis, 13.1.1967 (MEL20462); (Sd) Tooradin, H. I. Aston 1581, 3.3.1967 (MEL20433-4); (Sd) 6 miles N.N.W. of Anglesea, H. I. Aston 1582, 21.3.1967 (MEL20435); (Sd) Airey's Inlet, H. I. Aston 1583, 22.3.1967 (MEL20436); Stony Rises, 2½ miles west of Pirron Yallock, H. I. Aston 1591, 11.4.1967 (MEL20437); Stony Rises, 3½ miles west of Pirron Yallock, H. I. Aston 1592, 11.4.1967 (MEL20438-40).

TASMANIA—Tasmania (MEL16314); Tasmania, R. C. Gunn, 1836 (NSW90544); Circular Head Neck, R. C. Gunn, in flower 10.12.1837, in fruit 23.1.1838 (NSW90541); George Town, R. C. Gunn, 22.10.1842 (HOB); (Sd)

Tasmania, *R. Gunn* 1216/1842, 10.1.1843 (MEL16285; BRI061769); Van Diemenland, *R. Gunn* (MEL16315); (Sd) Distillery Creek, *R. C. Gunn*, 1.1.1845 (HOB); (Sd) South Esk River, *C. Stuart* 167, 1848 or 9 (MEL16298); South Esk River, *C. Stuart* 273, ?1849 (MEL16287); Barnard's Creek, 6 miles from Launceston, *S. Hannaford* 170, 26.11.1864 (MEL16280; HOB); (Sd) Tasmania, *S. G. Hannaford* (NSW90546); (Sd) Huon Road, *S. G. Hannaford* (HOB); (Sd) Tasmania, *W. H. Archer* (NSW90545); (Sd) Swanport, *Dr. Story* (MEL16310); (Sd) Between Bridgewater and New Norfolk, Feb. 1869 (MEL16284) "in watercourses on marshes"; Lake St. Clair, *T. Gulliver*, Mar. 1873 (MEL16288); Lake St. Clair, *T. & B. Gulliver*, 1873 (MEL16291) "4000'"; (Sd) Huon Road, from *A. Simpson's* collection, Feb. 1878 (HOB); Cape Portland, *Mrs. Bowen*, Mar. 1885 (MEL16293); N. E. Tasmania, *Mrs. Bowen*, 1887 (MEL16295); Port Arthur, *Rev. J. Bufton*, 1892 (MEL16296); Tasmania, *Rev. J. Bufton*, 1892 (MEL16297); (Sd) Near Launceston, *L. Rodway*, Nov. 1894 (HOB); (Sd) Bellerive, *A. H. S. Lucas*, Dec. 1924 (NSW90543); (Sd) Little Hampton, *F. H. Long* 1133, 30.1.1932 (HOB) "Water herb" "height 2 ft." "Marsh lands" "Flower yellow" "Alt. 600 ft."; St. Clair, *W. M. Curtis*, 8.2.1945 (MEL16321) "in swamp at H.E. workings"; Scamander, *H. D. Gordon*, 16.11.1945 (MEL16322) "Marsh behind sand dunes"; Blackman River at Tunbridge, *W. M. Curtis*, 14.12.1955 (HOB) "river flat"; (Sd) Meander River flats, 5 miles S. of Deloraine, *J. Somerville*, 2.1.1959 and 3.1.1959 (HOB) "swamp" "alt. c.800'"; (Sd) Between Lake Sorell and Great Lake, *Hj. Eichler* 16942, 6.2.1960 (AD96109201); Cape Portland area, *Mrs. M. Cameron*, 6.11.1966 (MEL20467); (Sd) Rocky Cape, N. W. coast, *J. H. Willis*, 4.1.1967 (MEL20465-6) "abundant and luxuriant under shade of *Melaleuca squarrosa* in a heathland swamp . . .".

## 12. *Villarsia umbricola* H. I. Aston sp. nov.

Herba aquatica vel semiaquatica, erecta usque ad reclinatam, gracilis, caespitosa, perennis, plerumque 30-75 cm. alta, panícula patenti multifloraque praedita. Corolla flava, 11-31 ( $\pm 21.7$ ) mm. diam.; pedicelli capsulae maturae (5-) 10-40 (-62) mm. longi, leniter recurvantes; semina (0.8-) 1-1.4 (-1.6) mm. longa, pallide ochracea usque ad cinnamomeas, nunquam cinerea vel nigra.

A *V. reniformi* R.Br. recedit sic: absentia stolonum; laminis foliorum minus dorsiventralibus, tenuius textis, pallidius flavo-virentibus, undulatis etiamsi natanibus (tum denique super aquam non prone jacentibus); culmis tenuioribus, debilioribus, plerumque semireclinatis; pedicellis longis in verticillis opinatis (partum usque ad 6) saepe constipatis, recurvatis in capsulis maturis; diametro parviore floris expansi. In characteribus seminis etiam differt.

Erect to reclining, slender, tufted perennial, without stolons. *Radical* leaves rising erect to spreading or reclining on land plants, erect to floating when in the water but then the blades remaining  $\pm$  undulate and not lying flat on the water surface, on petioles 1-17 in. long; blades from elliptic (rarely) to ovate to broad-ovate (occasionally broader than long) to sometimes almost round, at times oblique, (1-) 2.5-8 (-12) cm. long x (0.7-) 1.5-6 (-11) cm. broad, apex obtuse to rounded, base from  $\pm$  truncate or sometimes rounded to slightly or deeply cordate, the lobes mostly  $\frac{1}{12}$ - $\frac{1}{6}$  of the leaf length but sometimes to  $\frac{1}{4}$ , sinus broad to narrow, edge entire and usually undulate, surfaces matt to semi-glossy, medium yellowish-green and  $\pm$  equal in colouration or the upper surface a little darker, dotted beneath but not over-conspicuously, texture somewhat thin. *Culms* several, ( $\frac{1}{4}$ -) 1-2 $\frac{1}{2}$  (-3 $\frac{1}{2}$ ) ft. high, much longer than the radical leaves, slender, weak, semi-erect or reclining on both land

and water plants, usually supported by surrounding vegetation, the first branch arising from  $(\frac{1}{13}-)\frac{1}{10}-\frac{1}{2}$  ( $-\frac{5}{8}$ ) of the culm height; cauline leaves 1-several, subtending the panicle branches, the lower radical-like on

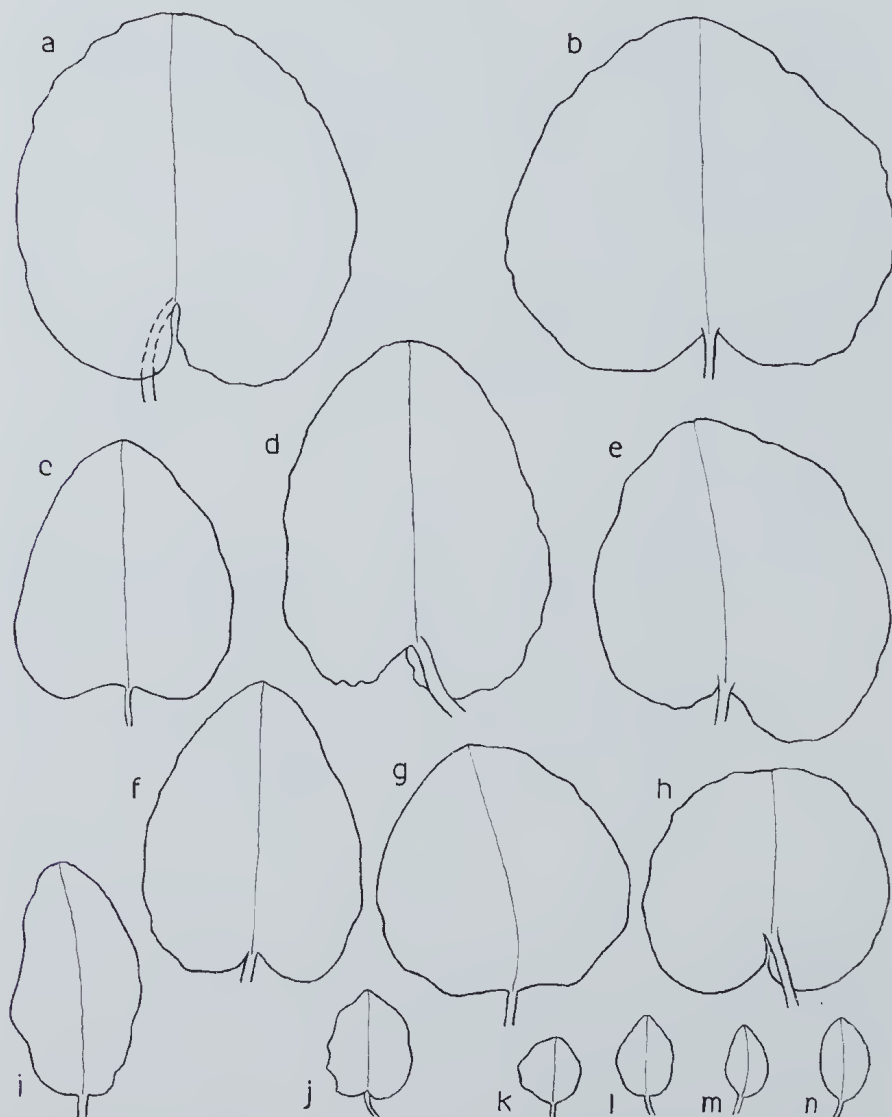


Fig. 32—*V. umbricola*, shape of radical leaves,  $\times \frac{2}{3}$ . a to h, usual shapes found in both varieties. a to e, var. *beaugleholei*. a and d, Aston 1427. b and e, Aston 1445. c, Aston 1515. f to h, var. *umbricola*. f, Aston 1527. g, Aston 1529. h, AD96102063. i, var. *umbricola*, Aston 1531. j to n, var. *beaugleholei*, Aston 1439 and A. C. Beauglehole 6781, reduced forms from plants in an open, roadside depression.



petioles from very short to 7 in. long, or sometimes all bractlike. *Inflorescence* a slender, open, many-flowered panicle, branching dichotomously, each pedicel arising singly in the axil of a bract, or by reduction of the internodes the culm branches and pedicels arising in apparent whorls or near-whorls of up to 6 members, in small plants the panicle much reduced; final bracts ovate-elliptic, 3–5 mm. long; pedicels (of mature capsules) (5–) 10–40 (–62) mm. long, erect in flower, gently recurving as the fruits mature. *Flowers* homostylous; calyx-lobes (3–) 6–8 (–9) mm. long, narrow to broad elliptic-ovate, thinly membranous on the edges,  $\frac{2}{5}$ – $\frac{3}{5}$  length of the corolla; corolla yellow, 7–15 mm. long, 11–31 (average 21.7) mm. span, lobes 5 or sometimes 4 or 6, variable in shape and apex (Fig. 2) without a longitudinal keel; gynoecium with 2 placentas, ovules 11–50 per placenta, style about 1.5–2 mm. long, stigmas 2, papillose, ca. 0.5–1 mm. long,  $\pm$  rotund to ovate and erect, held about level with the anthers; anthers 1.5–2.5 mm. long, on short filaments 0.5–1.5 mm. long. *Capsule* (5–) 6–11 mm. long, from equal to the calyx-lobes to exserted beyond them by  $\frac{1}{3}$  (– $\frac{1}{2}$ ) their length (sometimes more), mostly noticeably exserted, chartaceous, globular- to ellipsoid-ovoid, adnate to the calyx-tube only at the base, dehiscing at the summit into 4 acute, somewhat-recurved valves. *Seed* (0.8–) 1–1.4 (–1.6) mm. long, pale cream to buff-fawn or light brown, never grey or black, compressed-ellipsoid to sub-cylindrical or sub-globular, without a conspicuous caruncle; surface slightly or strongly marked with minute “jig-saw” patterns, almost smooth to slightly granular, mostly glossy, also in the var. *beaugleholei* strongly tuberculate.

var. *umbricola*.

Semen paene glabrum usque ad parve granulatum.

Seeds ellipsoid or irregularly so, compressed, double convex, mostly glossy; surface slightly or strongly marked with minute “jig-saw” patterns, almost smooth to slightly granular, without tubercles but sometimes with some of the granules more pronounced and with several microscopic projections on the summit of each.

var. *beaugleholei* H. I. Aston var. nov.

Semen fortiter denseque tuberculatum.

Seeds ellipsoid, somewhat compressed but turgid, at times almost sub-cylindrical or sub-globular; surface slightly or strongly marked with minute “jig-saw” patterns, and also strongly tuberculate, the tubercles hollow, to 0.75 mm. long, and each again minutely tuberculate at its summit, rarely the tubercles reduced to granules over the centres of the seed faces.

DISTRIBUTION:

var. *umbricola*:—South Australia—Mt. Lofty Ranges from around Adelaide south to the extremity of the Fleurieu Peninsula, also Kangaroo Island and south-east of S.A. There is an outlying northern record from Wirrabara, north-east of Port Pirie. Victoria—Bridgewater Lakes west of Portland.



var. *beaugleholei*:—South Australia—extreme south-east. Victoria—south-west, in the vicinity of the Grampians and the Glenelg and Wannon Rivers system.



Fig. 33—*V. umbricola* var. *umbricola*, distribution map.

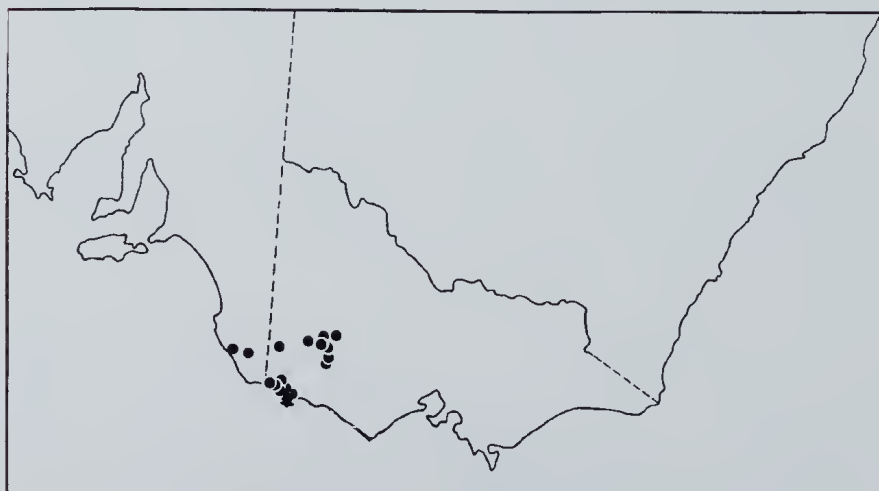


Fig. 34—*V. umbricola* var. *beaugleholei*, distribution map.

#### HABITAT:

Typically sheltered, shaded or semi-shaded situation on damp soil or in shallow fresh waters, sometimes in water to 18 inches deep. On damp soil in *Eucalyptus obliqua* and *E. ovata* forests (var. *beaugleholei*), commonly edging or beside small creeks and in bogs, also in or beside

swamps. Mostly sheltered by taller shrubs and vegetation but sometimes in the open and then growing well if in water but suffering reduction if on damp soil only.

Some associated species recorded are *Leptospermum juniperinum*, *L. lanigerum*, *L. obovatum*, *Melaleuca decussata*, *M. squamea*, *M. squarrosa*, *Olearia glandulosa*, *Gahnia* sp., *Restio tetraphyllus*, *Lepidosperma laterale*, *Carex appressa*, *Schoenus tesquorum*, *Juncus articulatus*, *Goodenia ovata*, *Selliera radicans*, *Haloragis brownii*, *Hydrocotyle* sp., *Ranunculus rivularis*, *Lobelia alata*, *Gratiola peruviana*, *Epilobium* sp., *Triglochin striata*, *Drosera binata*, *Blechnum* sp., and *Myriophyllum pedunculatum*.

#### FLOWERING TIME:

var. *umbricola*:—Fl. and Fr. recorded Nov.-April.

var. *beaugleholei*:—Fl. and Fr. recorded Nov.-Dec., but season apparently extends further as there are still many buds on plants seen in December.

#### TYPIFICATION:

var. *umbricola*:—Holotype—(Sd) Ca. 4 miles direct line E.S.E. of Myponga, between Myponga and Hindmarsh Valley, *H. I. Aston 1531*, 18.12.1966 (MEL20485). Isotypes—AD, NSW, K. Paratypes—(Sd) Mt. Lofty Railway Enclosure, just south of Mt. Lofty Rly. Stn., *H. I. Aston 1532*, 19.12.1966 (MEL20484 and AD, NSW, PERTH, K, BM); (Sd) Callawonga Creek, about 1.3 road miles south of the Victor Harbor to Cape Jervis road, *H. I. Aston 1530*, 18.12.1966 (MEL20486 and AD, NSW, K). The second paratype has the seeds rougher, with more pronounced granules, than have the other designated types.

var. *beaugleholei*:—Holotype—(Sd) 1.3 miles west of Dergholm, along the road to Penola, *H. I. Aston 1445*, 15.12.1965 (MEL16415). Isotypes—MEL16416-17 and AD, NSW (2 sheets), K, BM, PERTH. Paratypes—(Sd) Ca. 4.5 miles N.N.W. of Dunkeld and 2 miles S. of Victoria Valley township, *H. I. Aston 1423*, 26.11.1965 (MEL16422-23 and AD, NSW, K, BM, PERTH, CANB, L); (Sd) Malseeds Lake, ca. 2 miles west of Mt. Richmond Post Office, *H. I. Aston 1514*, 13.12.1966 (MEL20480-81 and AD, NSW, K, BM). The second paratype shows smaller foliage than the other types selected, but lies well within the range of variation shown by the variety.

#### DISCUSSION:

The erroneous recording by Black (1957, p. 693) of *V. parnassifolia* in South Australia seems to have been based on misidentification of this previously unrecognised entity, *V. umbricola*.

*V. umbricola* overlaps the range of *V. reniformis* and cannot always be distinguished from it by herbarium specimens alone as these have not always been collected adequately and seldom indicate flower measurements. Flowers themselves are rarely collected, and even if

present with specimens are usually valueless because of their deliquescent nature. However, populations in the field are readily distinguished when flowering or fruiting, and can often also be separated when vegetative only. The less dorsio-ventral, thinner-textured, paler, usually more yellowish-green foliage, with blades not lying flat on the water surface even when floating, the slender, semi-reclining, weak culms with long pedicels often partially grouped in apparent near-whorls, the slender pedicels recurved in fruit, and the smaller flowers are features which separate *V. umbricola* from *V. reniformis*. In addition, the tuberculate seeds of var. *beaugleholei* are quite distinct from the smooth seeds of *V. reniformis*. The seeds of var. *umbricola* however, although tending to be less compressed and more granular than those of *V. reniformis*, are not considered reliably distinctive in all cases.

The two varieties of *V. umbricola* are distinguished by seed alone. Within Victoria all collections of var. *beaugleholei* show the strongly tuberculate surface and generally are rather turgid and semi-cylindrical. At Rendelsham, between Millicent and Beachport in South Australia, both varieties were found growing intermingled in an extensive population (Aston 1520-23). Seeds of var. *beaugleholei* here showed a trend in characters towards those of var. *umbricola*, being more compressed and having the tubercles shorter and occurring only around the borders and face edges, the centres of the seed faces being granular. Some plants, however, retained the strongly tuberculate seed surface all over. Seeds of var. *umbricola* were either typically granular or had the granules around the borders and face edges somewhat more pronounced with each bearing microscopic projections on its summit suggestive of those occurring on the summits of the tubercles of var. *beaugleholei*. This variation in the degree of smoothness or the pronouncement of the granules of var. *umbricola* seeds occurs right throughout its range.

Measurements made have shown tendencies for var. *beaugleholei* to have slightly smaller seeds and smaller flower span than var. *umbricola*. As the number of populations investigated is small, and the number of individuals available in each varied considerably, these tendencies should not be considered significant at this stage. They require fuller investigation. Even if biologically significant, the different seed and flower span sizes are of no value for identification purposes as the extremes of measurement in each case are almost identical for both varieties, and the norms lie close together. Measurements are:—var. *beaugleholei*, flower span 11-29 (average 20.1) mm. for 82 individuals of 10 collections, seeds (0.8-) 1-1.3 (-1.6) mm. for 639 indiv. of 20 collections; var. *umbricola*, flower span 14-31 (average 23.7) mm. for 69 indiv. of 6 coll., seeds (0.9-) 1-1.4 (-1.6) mm. for 774 indiv. of 23 coll. Figures 1 and 5 should also be consulted.

The distinctive turgid and rough seeds of the present *V. umbricola* var. *beaugleholei* were commented on by Mueller almost exactly a century ago when he wrote (Mueller 1868, p. 140) of a plant from the

Wannon River in the Grampians, Victoria. At that time he retained the collection concerned under *V. reniformis*, an understandable decision as he had no further specimens.

The specific epithet is given in reference to the usual habitat preferred by this species as a whole, while the epithet of the var. *beagleholei* is bestowed in honour of Mr. (Cliff) and Mrs. (Hilda) A. C. Beaglehole of Gorae West, via Portland, Victoria. Without Cliff's splendid botanical knowledge and their combined assistance in offering local guidance and friendly hospitality on several occasions I could never have investigated the villarsias of their district so successfully.

#### SPECIMENS EXAMINED (EXCLUDING TYPES):

var. *umbricola* :—

SOUTH AUSTRALIA—(Sd) Macclesfield, and Torrens River, *F. Mueller*, Nov. 1849 (MEL16404); (Sd) Torrens near Port Adelaide, *Blandowski*, 1850 (MEL16400); (Sd) Clarendon, *Tepper* 398, 1881 (MEL16398); Wirrabara, ca. 30 km. N.E. of Port Pirie, *Herb. R. Tate*, 19.11.1881 (AD966100354); (Sd) Myponga, *Herb. J. M. Black*, 16.11.1922 (AD966100358); (Sd) Tooperang, *C. M. Eardley*, Dec. 1937 (ADW); (Sd) Callawonga Creek, *F. M. Hilton*, 25.11.1953 (ADW18798); (Sd) Mt. Compass, along the Nangkita road, *D. J. E. Whibley* 29, 15.11.1956 (AD95712020); (Sd) Boat Harbour Creek, between Cape Jervis and Victor Harbour, *Hj. Eichler* 14417, 16.11.1957 (AD95826012); (Sd) 3 miles S. of the intersection of the Tunkalilla and the Victor Harbour-Cape Jervis roads, *R. Schodde* 601, 25.1.1958 (AD96029040; CANBLR); (Sd) Deep Creek near mouth, *Fleurieu Peninsula, E. N. S. Jackson* 13, 11.1.1959 (AD96102063); (Sd) Lake Bonney, 10 km. S.W. of Millicent, *P. Wilson* 1179, 13.11.1959 (AD96020270; MEL16402); (Sd) Reservoir near Mt. Lofty Station, *E. H. Ising*, 22.3.1961 (AD96151103); (Sd) Reservoir near Mt. Lofty railway station, *E. H. Ising*, 8.12.1961 (AD96207255); (Sd) At reservoir near Mt. Lofty railway station, *E. H. Ising*, 22.12.1962 (AD96421083); (Sd) Mt. Lofty railway reservoir enclosure, *Hj. Eichler* 17147, 5.1.1963 (AD96445390; MEL16401); (Sd) Between Myponga and Hindmarsh Valley, *N. N. Donner* 950, 3.12.1963 (AD96414104; MEL16403); (Sd) Rocky River, Flinders Chase, Kangaroo Is., *Hj. Eichler* 18577, 5.1.1966 (AD966110341; MEL16399); (Sd) Strangways Falls, just N.E. of Inman Valley, *D. J. E. Whibley* 1731, 23.11.1966 (AD96651041; MEL20483); (Sd) Strangways Falls, just N.E. of Inman Valley, *D. J. E. Whibley* 1740, 23.11.1966 (AD96651042; MEL20482); (Sd) 4.5 miles N.W. of Rendelsham, *H. I. Aston* 1521, 16.12.1966 (MEL20491); (Sd) 4.5 miles N.W. of Rendelsham, *H. I. Aston* 1523, 16.12.1966 (MEL20490); (Sd) 2.5 miles E.S.E. of Robe, *H. I. Aston* 1527, 16.12.1966 (MEL20489); (Sd) Finnis, *H. I. Aston* 1528, 17.12.1966 (MEL20488); (Sd) Willow Creek, 10 miles direct line west of Victor Harbour, *H. I. Aston* 1529, 18.12.1966 (MEL20487).

VICTORIA—(Sd) Bridgewater Lakes, about 11 miles west of Portland, *F. Swindley* 1590, 4.4.1963 (MEL1177); (Sd) Bridgewater Lakes, *H. I. Aston* 1443 and *A. C. Beaglehole* 6783, 14.12.1965 (MEL16397-7A; *Herb. A.C.B.*); (Sd) Bridgewater Lakes, *H. I. Aston* 1516, 14.12.1966 (MEL20492-3).

var. *beagleholei* :—

SOUTH AUSTRALIA—(Sd) Between Kalangadoo and Millicent, *J. B. Cleland*, 6.12.1922 (AD966100417); (Sd) 4.5 miles N.W. of Rendelsham, *H. I. Aston* 1520, 16.12.1966 (MEL20476); (Sd) 4.5 miles N.W. of Rendelsham, *H. I. Aston* 1522, 16.12.1966 (MEL20475).

VICTORIA—(Sd) Banks of the Wannon, *C. Wilhelmi*, Dec. 1856 (MEL16408); (Sd) Wannon, Coll. ? *Wilhelmi* or *F. Mueller*, (MEL16409); (Sd) Lower Glenelg River, *Eckert* 62, 1891 (MEL16407); (Sd) Scrubby Creek, Victoria Valley, Grampians, *H. I. Aston* 1412, 24.11.1965 (MEL16419-21); (Sd) Ti-tree Creek, 12.5 miles S. of Cherrypool, *H. I. Aston* 1427, 26.11.1965 (MEL16410-2); (Sd)



Cherry pool, *H. I. Aston 1429*, 26.11.1965 (MEL16413-4); (Sd) 6 miles N.W. of Portland, *H. I. Aston 1436*, 13.12.1965 (MEL16424); (Sd) 4.5 miles W.N.W. of Gorae West School, *H. I. Aston 1438* and *A. C. Beaglehole 6780*, 14.12.1965 (MEL16426-7; Herb. A.C.B.); (Sd) 2.5 miles N.N.E. of Mt. Kincaid, *H. I. Aston 1439* and *A. C. Beaglehole 6781*, 14.12.1965 (MEL16425; Herb. A.C.B.); (Sd) Drik Drik, *H. I. Aston 1441*, 14.12.1965 (MEL16428); (Sd) Balmoral, *H. I. Aston 1451*, 16.12.1965 (MEL16418); (Sd) Lake Bung Bung, 10 miles E. of Nelson, *A. C. Beaglehole 22202*, 12.6.1966 (Herb. A.C.B.; MEL25466); (Sd) Branch Creek, Victoria Valley, Grampians, *A. C. Beaglehole 22*, 201, 10.12.1966 (Herb. A.C.B.; MEL25465); (Sd) Glenelg River, 3 miles S.S.E. of Mt. Thackeray, Grampians, *A. C. Beaglehole 22200*, 10.12.1966 (Herb. A.C.B.); (Sd) Long Swamp, Nelson, *H. I. Aston 1515*, 13.12.1966 (MEL20477-9); (Sd) Malseed's Lake, ca. 2 miles west of Mt. Richmond Post Office, *A. C. Beaglehole 22203*, 13.12.1966 (MEL25505-6; Herb. A.C.B.).

Variety uncertain as all specimens lack seeds :—

SOUTH AUSTRALIA—North Adelaide, *F. Mueller*, 23.1.1848 (MEL16405); Lake Bonney, *Miss Wehl*, 1887 (MEL16406); Aldgate, *Ashby*, 19.11.1895 (AD966041068); Eight Mile Creek, South East, *C. M. Eardley*, 4.2.1942 (ADW); Port MacDonnell, *C. M. Eardley*, 5.2.1942 (ADW); Callawonga Creek, Fleurieu Peninsula, *D. E. Symon*, 25.11.1953 (ADW18621); Edinburgh Swamp between Myponga and Hindmarsh Valley, *Hj. Eichler 12195*, 23.2.1956 (AD95903044).

VICTORIA—Fyans Creek, Grampians, *J. H. Warcup*, 24.1.1961 (ADW23750); ± 7 miles N.W. of Zumsteins on main road to Horsham, *D. E. Symon 1642*, 30.10.1961 (ADW25085); Fyans Creek, Grampians, *D. E. Symon 1852*, 7.11.1961 (ADW25083); Near Glenelg River crossing on Casterton-Edenhope road, *F. Swindley 1138*, 29.11.1962 (MEL254).

#### ACKNOWLEDGEMENTS

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PLATE 1



NATIONAL HERBARIUM OF VICTORIA  
*Villarsia submersa*  
 Helen I. Aston  
 Det. *HIA* 4/9/69 HOLOTYPE

STATE HERBARIUM  
 WESTERN AUSTRALIA  
 Flo. white, petals woolly; rooted in mud, leaves  
 + petiole branches wholly submerged. Water 18" deep  
 Loc. Boyanup  
 Coll. R. D. ROYCE 3778 9 Sept 1951.

Holotype of *V. submersa* H. I. Aston.

PLATE 2



Holotype of *V. umbriola* H. I. Aston var. *beaugleholei* H. I. Aston.



# A REVIEW OF THE GENERA *TELOSCHISTES* AND *XANTHORIA* IN THE LICHEN FAMILY *TELOSCHISTACEAE* IN AUSTRALIA

by

REX B. FILSON\*

## SUMMARY

The Australian representatives of *Teloschistes* and *Xanthoria* are reviewed. Keys and descriptions are given for the ten species and two forms.

One new form is described, *Teloschistes spinosus* forma *subteres*, and two new combinations are made, *Xanthoria ectanea* and *Teloschistes velifer* forma *nodulosa*.

Distribution is fully discussed and maps have been provided with particular emphasis on Victorian occurrences.

## INTRODUCTION

In reviewing the Australian species of *Teloschistaceae* the author has been confused by the utmost variance between authors regarding the systematic position of certain species. For instance, *Teloschistes spinosus* (Hook. f. & Tayl.) J. Murray has received the following treatment:

The late Dr. James Murray formerly of the Dominion Museum, New Zealand, made his new combination *Teloschistes spinosus* (Murray, 1960: p. 205) based on *Parmelia spinosa* Hook. f. & Tayl. (Hooker & Taylor, 1844: p. 644), including *T. sieberianus* (Laur.) Hillm. (Hillman, 1930: p. 315) in synonymy. Hillman's species was based on *Parmelia sieberiana* Laur., described in 1827 (Laurer, 1827: p. 38). Dr. J. Müller of Argau had previously taken up this epithet in varietal status under *Teloschistes chrysophthalmus* (L.) Th. Fr. in 1883 (Müller J., 1883). Dr. Du Rietz bases his *Xanthoria spinulosa* (Du Rietz, 1922: p. 211) on *Physcia parietina* var. *spinulosa* Krplhb. (Krempelhuber, 1868: p. 322). Krempelhuber described this variety from material collected in Van Diemens Land by Hügel. Specimens in the National Herbarium Melbourne originally labelled *Parmelia spinosa* Hook. f. & Tayl. have been redetermined and annotated *Physcia spinosa* (Hook. f. & Tayl.) Krplhb., by Krempelhuber. This is apparently an unpublished combination made by Krempelhuber, and on reviewing his determination later, he made it a variety of *Physcia parietina*.

Dr. A. Zahlbrückner in his *Catalogue Lichenum Universalis* (Vol. 7. p. 318) follows J. Müller in retaining *Sieberianus* as a variety of *chrysophthalmus*, under which he synonymises *Parmelia sieberiana* Laur., *Parmelia spinosa* Hook. f. & Tayl., *Physcia Sieberiana* (Laur.)

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\* National Herbarium of Victoria.



Mass. (Massalongo, 1853: p. 44), *Blasteniospora Sieberiana* Trevis. (Trevisan, 1853: p. 2), *Physcia chrysophthalma* Shirley (Shirley, 1890: p. 193) and *Teloschistes Sieberianus* Hillm. Yet, on page 307, he also upholds *Xanthoria spinosa* Du Rietz which was certainly based on *Parmelia spinosa* Hook. f. & Tayl. Under *X. spinosa* Zahlbrückner synonymised *Physcia parietina* var. *spinulosa* Krphlb., *Teloschistes velifer* Wilson (Wilson, 1889: p. 69), *Xanthoria parietina* var. *spinulosa* Müll. Arg. (J. Müller, 1894: p. 40) and *Xanthoria spinulosa* Hillm. Dr. Zahlbrückner apparently overlooked the fact that he had *Parmelia spinosa* synonymised with both species!

A specimen that was collected on rocks on Deal Island, Kent Group, Bass Strait by Robert Brown in December 1803, was determined by Dr. Nylander as *Physcia subexilis* Nyl. (Crombie, 1879: p. 396), this taxon was later relegated to a variety of *Teloschistes flavicans* (Sw.) Norm. by Rev. F. R. M. Wilson (Wilson, 1892: p. 176).

The present author has reviewed the type specimens of *Parmelia spinosa* Hook. f. & Tayl. and *Physcia subexilis* Nyl. and has found them to be, in the main parts, identical with each other and to fit into a group that we shall call the "*Teloschistes chrysophthalmus* complex".

This whole group is a very confusing one, the species being so variable as to suggest that they are all just forms of the one entity. *T. chrysophthalmus* and *T. xanthoroides* J. Murray (Murray, 1960: p. 209) are at the extreme ends of the "*chrysophthalmus* complex" whilst *sieberianus*, *spinus* and *fasciculatus* grade evenly between them.

*T. spinosus* forma *subteres* appears to occupy an intermediate position between *T. sieberianus* and *T. spinosus*; owing to the lack of soredia the affinities seem closer to the former species, but as the whole group is so flexible the author has ascribed it to *spinus* because of the fineness of the thalline filaments. It is most often found forming flat rosettes but occasionally it forms pulvinate clumps, specimens from Wilson's Promontory illustrate this variation.

All of these forms grade into one another so evenly that it is impossible to draw a line of demarcation between them.

The author has examined the New Zealand type of *Teloschistes flavicans* var. *compressus* J. Murray (Murray, 1960: p. 206), and has found this species to occupy an intermediate position between *T. spinosus* forma *subteres* and *T. flavicans* (Sw.) Norm. (Norman, 1853: p. 229).

Concerning *T. chrysophthalmus*, many forms and varieties have already been recorded for Australian localities. These are var. *leucoblepharis* Müll. Arg. (J. Müller, 1883: p. 77), var. *leucoloma* Müll. Arg. (J. Müller, 1883: p. 77), var. *forficatus* Müll. Arg. (J. Müller, 1896: p. 89), var. *depressus* Müll. Arg.\*, var. *alatus* (Wils.) Shirley (Shirley, 1892: p. 133), var. *denudatus* Müll. Arg. (J. Müller,

\* *Teloschistes chrysophthalmus* var. *depressus* Müll. Arg. is apparently an unpublished Ms name.

1883: p. 265), var. *subinermis* Müll. Arg. (J. Müller, 1880: p. 265), var. *expallens* Müll. Arg. (J. Müller, 1883: p. 78). In the National Herbarium Melbourne there is a duplicate of the type of var. *leucoloma* and specimens authenticated by Müll. Arg. of var. *leucoblephora*, and var. *depressus*. On examination of this material the author feels that their macroscopic differences do not warrant varietal rank, and that they fit evenly into the gradient of the "chrysophthalmus complex". The fact that most of them are sterile is quite unimportant, since all Australian representatives of *Teloschistes* are microscopically identical. A specimen of var. *fornicatus* authenticated by Müll. Arg. agrees with his description and appears to be conspecific with *T. velifer* Wilson. Of the others, var. *alatus*, var. *subinermis*, and var. *expallens*, seem from the descriptions to be colour forms. Variation in colour in the Teloschistaceae, depends primarily on the light intensity of the habitat, for example, when *Xanthoria parietina* is observed on tree trunks, it assumes a grey-green colour where the light intensity is relatively low, but is flame-orange in the open sunlight. The colour of the margin to the apothecium is also variable, sometimes being concolorous with the thallus, sometimes much lighter and sometimes coloured the same as the apothecial disk.

*Teloschistes flavicans* (Sw.) Norm. and varieties, viz. *acromelus* (Nyl.) Müll. Arg. (J. Müller, 1879: p. 168), *croceus* (Ach.) Müll. Arg. (J. Müller, 1888: p. 493) and *subexilis* Wilson are recorded as having been collected from various localities in the Commonwealth, representatives of some of these collections are however absent from Australia's Herbaria. The only collections known, are housed in the National Herbarium Melbourne where there are only two specimens from authentic Australian localities. These are *Physcia flavicans* Australia and *Physcia acromela* Nyl., determinavit on both labels is written by Krempelhuber. The latter specimen was collected in New South Wales by Ludwig Leichhardt and is fertile, and forms the basis for the apothecial descriptions in the following texts.

The author considers *T. flavicans* to be an elastic species and such differences as black tipped or concolorous fibrils are not specific, as specimens are found with mixed coloured fibrils. Some authors have chosen to divide *T. flavicans* into subspecies based on the occurrence of soredia; but the present author believes that soredial development in this species is merely a factor of environment and has no real taxonomic significance.

Dr. Zahlbrückner (1931: p. 307) synonymised *T. velifer* Wilson under *Xanthoria spinosa*, but this species characteristically belongs with *Teloschistes* and may be distinguished from *T. chrysophthalmus* by the mature thallus-lobes which are slightly hooded and beset with soredia under the open ends.

The late Dr. James Murray (1960: p. 208) in his discussion on this species, incorrectly states that Wilson in his type description "gives details of the apothecia despite the statement that the specimens were

sterile!'. Murray also makes the note (p. 209) that "fruiting specimens must be very rare and have not certainly been reported before". Dr. Murray accepted Wilson's report of the lichens collected on his Tasmanian trip (Wilson, 1892: p. 176) to be the type description, whereas in fact Wilson described the species three years previously from specimens collected at Maffra, Victoria, March 1889, and this collection is copiously fertile. In his report of his Tasmanian trip, Wilson merely repeated his type description of the species and added that the specimens here cited were sterile.

Dr. Murray (1960: p. 206) described a new variety, *T. fasciculatus* var. *nodulosa* as being an alpine form of a subalpine species. In similar forms from the alpine regions of south-eastern Australia the presence of broad-hooded and sometimes contorted lobes was evident. The author examined Murray's material and located similar lobes to those found in the Australian specimens. As these lobes are characteristic of *T. velifer* the author feels that this form rightly belongs to that species and has accordingly made the combination.

Murray points out (1960: p. 208) that juvenile specimens are very hard to separate at the specific level. This form is also difficult to place in its correct category if the broad lobes are not present.

In a similar manner to *Teloschistes*, *Xanthoria* has been divided and subdivided. All of the Australian material has been included under *Xanthoria parietina* or one of its subspecies. The late Dr. J. Murray has placed all but one of the New Zealand specimens in this group also. In Zahlbrückner's Catalogue some 40 varieties and forms are listed for *X. parietina* and more have been described since.

The author believes that the typical form of *X. parietina* has been introduced into this country as it is rarely seen far from the settled areas. Dr. Murray (1960: p. 199) also makes this observation for New Zealand forms of the species. In Australia it certainly seems to favour the exotic trees.

The type description of *Parmelia parietina* var. *ectanea* Ach. is very brief, and apart from the statement that the lobes are narrower makes very little distinction between this and the typical variety. The type specimen is very fragmentary and comprises only one or two lobes barely 4 mm. square. Since the author is unable to establish any significant differences between the species native to Australia and the original concept of *Xanthoria parietina* var. *ectanea*, he prefers to apply the name *X. ectanea* to the Australian entity which he believes warrants specific rank. If subsequent research reveals that var. *ectanea* is only a coastal modification of *X. parietina* var. *parietina* as suggested by Richardson (1967: p. 391) then a new name will be required for the Australian species.

## MORPHOLOGICAL CHARACTERS

The morphological characters most likely to cause confusion in the determination of species in the genus *Teloschistes* are the presence of cilia and rhizines.

Rhizines are formed on the under surface and are a continuation of the lower cortex; they can be simple or branched.

Cilia are hair-like fibrils arising from the upper cortex or extending from the margin of the thallus. When determining the source of these structures it is important to examine the youngest marginal lobes and not the old contorted central portions of the plant. Observation of the contorted lobes can give a false impression, since it is sometimes hard to distinguish between margin and upper or lower surface.

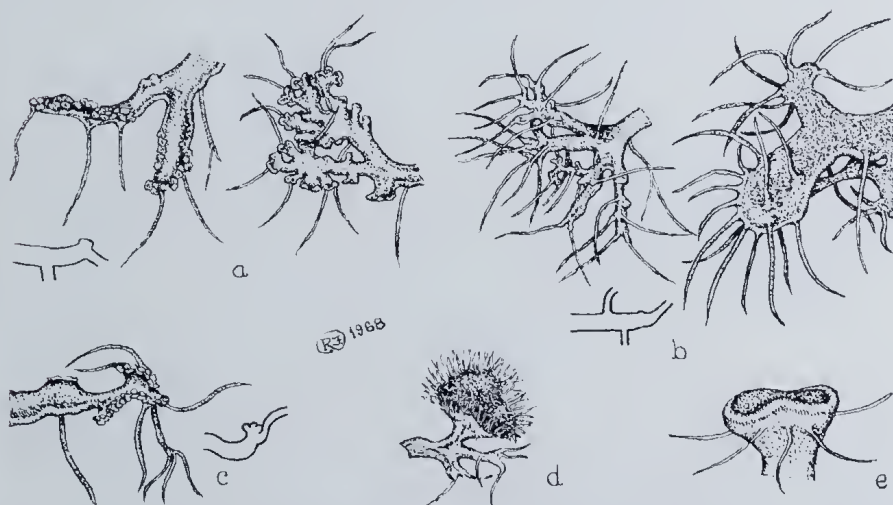


Fig. 35. *a.* Portion of the thallus showing position of rhizines on the under-surface; *b.* portion of the thallus showing cilia on the margins and upper surface, as well as rhizines on the lower; *c.* a contorted lobe showing how rhizines can be confused with marginal cilia; *d.* an apothecium with marginal cilia; *e.* an apothecium with naked margin, showing cilia on the underside.

## CHEMISTRY

The chemistry of all species of the Teloschistaceae represented in Australia is similar. Parietin which gives a blood-red reaction with potassium hydroxide ( $K+$  blood-red to purple) is present in the cortex. The species have a negative reaction with calcium hypochlorite ( $C-$ ) and para-phenylene diamine ( $P-$ ).

## METHOD

The dried specimens were first softened in water to which a few drops of detergent were added to hasten the penetration. The use of a Reichart freezing microtome OMP greatly reduced the time needed to section,



stain and mount the specimens. Once cut, the specimens were mounted in Lacto-phenol. Acid fuchsin and cotton blue were added to the mounting medium for differential staining of the sections.

Measurements expressed in millimetres and microns ( $\mu$ ) were made by inserting a micrometer disk into the 10x ocular of the microscope and calibrating for the various objectives of the instruments used.

The colours expressed in the botanical descriptions in this work were made by comparison with the plates in *A Dictionary of Colour*, Maerz and Paul (1930).

#### KEY TO AUSTRALIAN *TELOSCHISTES* AND *XANTHORIA*

- 1a Laciniae narrow and ramulose, lobes beset with fine rhizines or cilia
  - 2a Major lobes of the thallus narrow terete
    - 3a Lobes with soredia or isidia-like grains on the margins, up to 0.5 to 1 mm. thick in usnea-like strands up to 3 cm. long.....*T. flavicans*
    - 3b Lobes without soredia or isidia-like patches on the margins.....*T. spinosus* f. *subteres*
  - 2b Major lobes of the thallus flat
    - 4a Lobes beset with cilia on the margins and occasionally on the upper surface, rhizines on the lower surface
      - 5a Mature lobes broad slightly hooded with soredia on the lower surface, under open ends
        - 6a Older lobes thick twisted, extremely sorediose, rhizines reduced to a few short fibrils.....*T. velifer* f. *nodulosa*
        - 6b Older lobes not thick or twisted and not extremely sorediose.....*T. velifer*
      - 5b Mature lobes not slightly hooded
        - 7a Thallus lobes beset with isidia-like nodules or soredia on the margins.....*T. spinosus*
        - 7b Thallus lobes not beset with isidia-like nodules or soredia on the margins
          - 8a Apothecia mostly pedicellate, margin beset with long fine cilia....*T. chrysophthalmus*
          - 8b Apothecia numerous mostly sessile or rarely raised up by the thickening of the thallus, margin naked (cilia occasionally on the underside).....*T. sieberianus*
    - 4b Lobes not beset with cilia on the margins or on the upper surface, rhizines on the lower surface
      - 9a Lobes beset with isidia-like grains or sorediose on the margins.....*T. fasciculatus*
      - 9b Lobes not beset with isidia-like grains or sorediose on the margins.....*T. xanthoroides*



- 1b Lacinae broadly flattened, subfoliose, lobes not beset with fine rhizines or marginal cilia
  - 10a Lobes ascending, large slightly hooded, soredia on the lower surface under open ends. .... *T. velifer*
  - 10b Lobes adpressed to the substratum, neither hooded nor sorediate.
    - 11a Thallus lobes thin, rugulose, ultimate lobes concave with raised flexuose margins. .... *X. parietina*
    - 11b Thallus lobes thick, smooth, ultimate lobes slightly convex and deflexed. .... *X. ectanea*

**Teloschistes chrysophthalmus** (L.) Th. Fries Gen. Heterolichen. eur. recogn. 51 (1861).

*Lichen chrysophthalmus* L. Mant. Plant. 311 (1771).

*Physcia chrysophthalma* (L.) D.C. apud Lam. et D.C. Flor. franc. ed. 3, 2: 401 (1805).

*Thallus* in small fruticose to sub-foliose clumps 2 cm. (–4 cm.) diam., and 0.5–2 cm. high: *Lobes* initially small 0.5–1 mm. wide with long spinulose marginal fibrils, french grey in shaded positions to nugget-bronze yellow in sunlit; developing to erect rigid dorsiventral lobes up to 2.5 mm. wide, sometimes submonophyllous; *Cortex* up to 40 (–60)  $\mu$  thick; *Rhizinae* 80–100  $\mu$  thick being a continuation of the lower cortex.

*Apothecia* terminal or on the margins of the lobes 1–6 mm. wide deeply convex: *Disk* light chrome-yellow to orange-peel: *Cortex* concolorous with the thallus: *Margin* slightly elevated with numerous spinulose fibrils 0.2–2 mm. long: *Hypothecium* 20–40  $\mu$  thick: *Hymenium* up to 80  $\mu$  tall: *Asci* 50–65  $\mu$  x 12–16  $\mu$ : *Ascospores* hyaline polaribilocular, canal mostly present, apparently disappearing, 15–16  $\mu$  x 7–8  $\mu$ .

#### SPECIMENS EXAMINED

VICTORIA—Warrnambool, *F. R. M. Wilson*, Nov. 1886 (NSW.L676): Camperdown, *F. R. M. Wilson*, Jan. 1888 (NSW.L677): Geelong, *F. R. M. Wilson*, Jan. 1888 (NSW.L674): Black Rock, *R. A. Bastow* 26.12.1899 (MEL7413): Mordialloc, *R. A. Bastow*, 2.1.1900 (MEL7410): Frankston, *R. A. Bastow*, 3.3.1900 (MEL7416): Camperdown, *Murdock*, ca. 1900 (MEL7401): Sorrento, *R. A. Bastow*, April 1900 (MEL7414): Sandringham, *R. A. Bastow*, 26.5.1900 (MEL7415): Thurla near Mildura, *J. H. Willis*, Sept. 1940 (MEL7460): Kulkyn National Park, *A. C. Beauglehole* 1162, Late Sept. 1948 (MEL11299): Beeac, *A. C. Beauglehole* 3744, 8.2.1952 (MEL10183): "Rock Ravine", *Drik Drik*, *A. C. Beauglehole* 3263, 24.2.1952 (MEL11294): Anglesea, *E. Packe*, 14.6.1953 (MEL7495): Rye, *Rex Filson* 4010, 27.11.1961 (MEL22639): Emu Creek near Sunbury, *Rex Filson* 4836, 20.5.1963 (MEL22640): Coliban River Falls, 4 miles SW. Redesdale, *Rex Filson* 5091, 10.8.1963 (MEL22641): Cape Patterson, *Rex Filson* 5188, 7.9.1963 (MEL22642): Along the cliffs at Portsea, *John Williams*, 21.5.1964 (MEL22396): 7½ miles

NNE. Yea, *Rex Filson* 6645a, 8.11.1964 (MEL22643): Mt. Cottrell, *Mary Todd*, 2.2.1965 (MEL7614): Beech Forest, *G. C. Bratt* 2069a, 8.3.1965 (MEL9341): 1 mile north of Anthony's Cutting, Great Western Highway, *Rex Filson* 7164, 29.4.1965 (MEL9385): Calder Highway ca. 10 miles west of Melbourne, *Bruce Fuhrer*, April 1965 (MEL16602): Portland, *Rex Filson* 7270, 22.5.1965 (MEL10161): Jones's Cliffs, Lower Glenelg River, *Rex Filson* 7283, 22.5.1965 (MEL10158): Ettrick, near bridge at the Bessiebelle turnoff, 4 miles from Tyrendarra, *Bruce Fuhrer*, 13.6.1965 (MEL16600): Red Cliffs, *Marie Allender*, 2.8.1965 (MEL11232): 21 miles north of Linga on the road to sunset tank, *Rex Filson* 7356, 7.8.1965 (MEL11288): Cope Cope,  $\pm$  8 miles SSE, of Donald, *J. H. Willis*, 16.10.1966 (MEL18295): Tongue Point, western coast of Wilsons Promontory, *J. H. Willis*, 13.1.1967 (MEL22397): Mount Misery (Mt. Kororoit), 5 miles north of Rockbank, *J. H. Willis*, 28.5.1967 (MEL22394).

TASMANIA—Cataract Gorge, *A. Bastow*, July 1892 (MEL7409): Cape Deslacs near South Arm, *Joe Cashin*, 5.5.1963 (MEL9346): Red Bill Beach near Bicheno, *R. G. Spencer*, Jan. 1965 (MEL9355): The Nut, Stanley, *J. H. Willis*, 29.1.1965 (MEL7587): Cape Deslacs, *G. C. Bratt*, 17.7.1965 (MEL18274): Prime Seal Point, Prime Seal Island, Furneaux Group, Bass Strait, *John Whinray*, 1.8.1966 (MEL17351): Roden Island, Furneaux Group, Bass Strait, *John Whinray*, 7.3.1966 (MEL16031): Little Green Island, Furneaux Group, Bass Strait, *John Whinray*, 27.3.1966 (MEL16040): Great Dog Island, Furneaux Group, Bass Strait, *John Whinray*, 27.4.1966 (MEL16035): Little Dog Island, Furneaux Group, Bass Strait, *John Whinray*, 28.4.1966 (MEL16599): West Sister Island, Furneaux Group, Bass Strait, *John Whinray*, 14.8.1966 (MEL18293): Sentinel Island, Furneaux Group, Bass Strait, *John Whinray*, 27.8.1966 (MEL18265): 400 yards east of Settlement Point turnoff, Flinders Island, Bass Strait, *John Whinray*, 27.9.1966 (MEL18268).

NEW SOUTH WALES—Mount Dromedary, *Mary H. Bate*, 1881 (MEL7392): Penhurst, *E. Cheel*, April 1901 (NSW.L697).

QUEENSLAND—Emu Vale near Tannymorel, *F. R. M. Wilson*, ?1889 (MEL7391).

SOUTH AUSTRALIA—Gawler Range, *Tietkens*, ca. 1880 (MEL7395): Flinders Range, *Ferd. Mueller*, Oct. 1851 (MEL7405): Cookes Plains, ca. 105km SE. Adelaide, Anon. 4.1.1887 (AD): Eyre Island, *Wood Jones*, 1921 (AD): Colona Station, near Fowlers Bay, *J. H. Willis*, 27.8.1947 (MEL7400): Warbla Cave region, *D. S. Kemsley*, 14.1.1952 (MEL7468): Cowell road, ca. 11 km. south of Iron Duke, Middleback Range, *E. Shaw*, Mar. 1962 (AD): Bool Lagoon, ca. 20 km south of Naracoorte, *D. Hunt*, Mar. 1962 (AD): Naracoorte District, *D. Hunt*, June-July 1962 (AD): Murray Bridge, *Lindley D. Williams* 1920, 12.7.1964: Waterfall Gully, Mount Lofty Ranges, *A. C. Beauglehole* 15072, 30.9.1965 (MEL23027): Menengie, *Lindley D. Williams* 2747, 16.2.1966: Stuart Highway 24 miles north of Port Augusta, *J. H. Willis*, 3.8.1966 (MEL17313): Near Salt Creek, Princes Highway, *G. C. Bratt* 67127, 30.9.1967.

WESTERN AUSTRALIA—Eucla, *J. Oliver*, 1882 (MEL7397): Fraser Range, *R. Helms*, Oct. 1891 (MEL7391): Forrest, *A. M. Baird*, Aug. 1930 (MEL7486): Pinjarra, *Hans Gloe*, Sept. 1946 (MEL7491): Pallinup River, 5 miles south of Borden, *J. H. Willis*, 4.9.1947 (MEL7459): Harvey, *R. D. Royce*, 15.7.1949 (PERTH): Hithergreen, SE. Busselton, *R. D. Royce*, 12.10.1949 (PERTH): Busselton, *R. D. Royce*, 18.10.1949 (PERTH): Boxer Island, Recherche Archipelago, *J. H. Willis*, 9.11.1950 (MEL7453): Mondrain Island, Recherche Archipelago, *R. D. Royce*, 5.2.1960 (PERTH): Dundas Rocks, South of Norseman, *A. C. Beauglehole* 14800, 18.9.1965 (MEL14328): 10 miles north of Chester Pass, *R. T. M. Pescott*, 8.10.1965 (MEL17322): On plain north of the Stirling Ranges, *N. N. Donner*, 13.10.1965 (MEL16195): 20 miles north of Arrino, *Rex Filson* 8515, 3.9.1966 (MEL18261): 7 miles north of the Murchison River Bridge on the Northwest Coastal Highway, *Rex Filson* 8568, 6.9.1966 (MEL18260): Northwest Coastal Highway at the Murchison River Bridge, *Rex*

*Filson* 8628, 7.9.1966 (MEL18245): 10 miles south of Northampton, *Rex Filson* 8674, 9.9.1966 (MEL18249): Geraldton to Mount Magnet road, 15 miles east of Wurarga, *Rex Filson* 8714, 10.9.1966 (MEL18241): 7 miles west of Burracoppin, *Rex Filson* 8945, and *A. S. George*, 19.9.1966 (MEL18240): 18 miles east of Gnowangerup, *Rex Filson* 8975, 27.9.1966 (MEL18262): Saddle between Nancy's Peak and the Devil's Slide, Porongorup Range, *Rex Filson* 9050, 29.9.1966 (MEL18242): Bremer Bay, *Rex Filson* 9103, 1.10.1966 (MEL18291): Jerramungup to Ravensthorpe road at the Phillips River crossing, *Rex Filson* 9165, 3.10.1966 (MEL18239): Dumbleyung to Wagin road, 6 miles west of Dumbleyung, *Rex Filson* 9390, 12.10.1966 (MEL18246):  $\pm$  100 miles northwest of Reid, *A. S. George* 8489, 14.10.1966 (MEL18357): Twilight Cove, *A. S. George* 8556, 16.10.1966 (MEL18350): 24 miles west of Balladonia, Eyre Highway, *A. S. George* 8602, 18.10.1966 (MEL18371):  $3\frac{1}{2}$  miles east of Kitchener, *A. S. George* 8620, 20.10.1966 (MEL18361): 68 miles W Caiguna, Eyre Highway, *G. C. Bratt* 67252, 6.10.1967: Lake Cowan, near Norseman, *G. C. Bratt* 67279, 6.10.1967: Wave Rock, 3 miles east of Hyden, *G. C. Bratt* 67337, 9.10.1967.

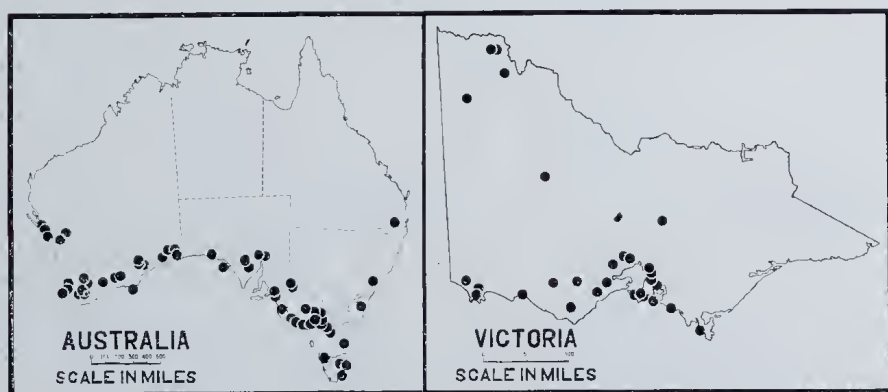


Fig. 36. Distribution map for *Teloschistes chrysophthalmus* (L.) Th. Fries.

***Teloschistes fasciculatus*** Hillm. in *Reprim* nov. Spec. Regni veg. 49: 176 (1938).

*Thallus* forming pulvinate clumps up to 4 cm. diam. and up to 2 cm. high: *Lobes* narrow prostrate becoming erect 0.1–0.75 mm. wide and up to 3 mm. long, dichotomously branched, wax-yellow to nugget-bronze-yellow, margins and upper surface bare, whitish to concolorous rhizines on the lower surface: *Cortex*  $40\mu$  thick, outer  $16\mu$  heavily encrusted with yellowish crystals, lower cortex  $60\text{--}80\mu$  thick: *Algal layer* discontinuous in scattered colonies throughout the medulla, cells  $9\text{--}16\mu$  diam.: *Medulla* loosely woven.

*Apothecia* not seen.

#### SPECIMENS EXAMINED

VICTORIA—Mount Buffalo, *P. N. S. Bibby*, 25.1.1946 (MEL10131): Head of Middle Creek, Bogong High Plains, *J. H. Willis*, Jan. 1946 (MEL7423): South side of ridge, South of Wallace's Hut, Bogong High Plains, *Coryl I. Skewes*,

25.1.1952 (MEL7487): Mount Buffalo, *Rex Filson* 3977, 24.9.1961 (MEL21957): Mount Nelse, Bogong High Plains, *Rex Filson* 8139, 20.1.1966 (MEL17326): Small hill to west of Wallace's Gap, Bogong High Plains, *Rex Filson* 8202, 22.1.1966 (MEL17312): Twin Knobs, The Razorback, *Rex Filson* 9891, 18.2.1967 (MEL22405): Northern Granite Knobs, Mount Cobberas, *Rex Filson* 10000, 21.2.1967 (MEL22404): Mount Fainter South, Bogong High Plains, *Rex Filson* 9604, 26.1.1967 (MEL22411).

NEW SOUTH WALES—Summit of Mount Kosciusko, *J. C. Singleton*, Feb. 1954 (MEL7475): Hill behind Kosciusko Chalet, *Rex Filson* 7952, 2.12.1965, (MEL16604).



Fig. 37. Distribution map for *Teloschistes fasciculatus* Hillm.

***Teloschistes flavicans* (Sw.) Norm.** in *Nyt Mag. Naturvid.* 7: 229 (1853).

*Lichen flavicans* Sw. *Nov. Gen. & Spec.* 147 (1788).

*Physcia flavicans* (Sw.) DC. *apud Lam. et DC. Flor. franc.* ed. 3, 2: 189 (1805).

*Teloschistes flavicans* f. *glaber* Wainio in *Acta Soc. Fauna Flora fenn.* 7: 114 (1890).

*Physcia acromela* Nyl. *Synops. Lichen* 1: 407 (1860).

*Teloschistes flavicans* var. *acromela* (Nyl.) Müll. *Arg. in Revue mycol.* 1: 168 (1878).

*Thallus* composed of terete or slightly flattened, angled laciniae, in loose clumps up to 8 cm. diam. and from 2–4 cm. high: *Lobes* 0.1–0.8 mm. diam. dichotomously branched, wax-yellow to nugget-bronze yellow, beset with scattered concolorous or black tipped fibrils up to 1 mm. long, when sorediate, sometimes erumpent or in patches loosely scattered on the cortex: *Cortex* 40–80 $\mu$  thick, the outermost 8–20 $\mu$  encrusted with yellowish crystals: *Algal cells* 7–13 $\mu$  diam. in scattered colonies immediately below the cortex, forming a discontinuous layer up to 40 $\mu$  thick, occasional colonies scattered throughout the medulla: *Medulla* of loosely compacted hyphae 4 $\mu$  thick.

*Apothecia* sessile, or slightly raised up on a thickening of the thallus, up to 4 mm. diam. plain to convex (to hemispheric): *Disk* orange-rufous: *Margin* slightly elevated, crenulate, concolorous with the thallus: *Hypothecium* 40 $\mu$  thick: *Hymenium* up to 80 $\mu$  tall: *Epithecium* up to



12 $\mu$  heavily encrusted with yellow crystals: *Paraphyses* branched 1.5–2.0 $\mu$  thick, apical cell expanded to 4 $\mu$ : *Asci* 60 $\mu$  x 16–20 $\mu$ : *Ascospores* 13–16 (–18) $\mu$  x 8–12 $\mu$  polaribilocular, canal mostly present.

#### SPECIMENS EXAMINED

NEW SOUTH WALES—Locality unknown, presumed to be in the far north-east, *L. Leiehardt* (MEL6351).

QUEENSLAND—Western side of Mount Huntley, Great Dividing Range, *A. B. Cribb*, 13.6.1965 (MEL10239): Mouth of Pine River, *A. B. Cribb*, 7.8.1965 (MEL14307): Mount Cordeaux, Cunningham's Gap National Park, *Rex Filson* 7788, 2.11.1965 (MEL14106): Between Millaa Millaa and Ravenshoe, *D. N. McVean* 63121: Binna-Burra region, Lamington National Park, *Marie Allender*, Oct. 1966 (MEL22410).

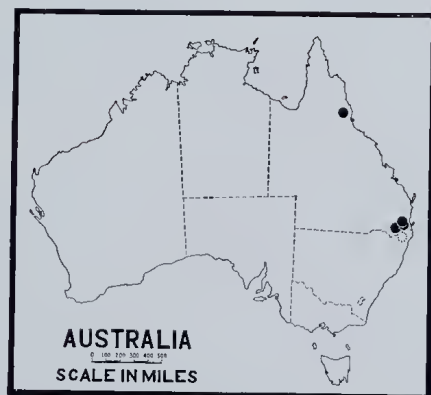


Fig 38. Distribution map for *Teloschistes flavicans* (Sw.) Norm.

#### ***Teloschistes sieberianus* (Laur.) Hillm. in Hedwigia 69 : 315 (1930).**

*Parmelia Sieberiana* Laur. in *Linnaea* 2: 38 (1827).

*Blasteniospora Sieberianus* (Laur.) Trevis. *Tornabenia et Blasteniospora* 2 (1853).

*Physeia Sieberiana* (Laur.) Mass. Mem. Lichenogr. 44 (1853).

*Telosehistes chrysophthalmus* var. *sieberianus* (Laur.) Müll. Arg. in *Flora*, Jena 66: 78 (1883).

*Physcia chrysophthalmus* var. *Sieberianus* (Laur.) Shirley The Lichen Flora of Queens. part IV. p. 193 (1890).

*Thallus* usually composed of flat, radiate, appressed to ascending lobes, up to 6 cm. diam. or forming a complete mat on the small branches, 2–5 mm. high: *Lobes* small 0.3–1 mm. wide, yolk-yellow to nugget-bronze-yellow, matt or vernicose, margins beset with concolorous fibrils up to 3 mm. long, occasional fibrils rising from the upper cortex and a few whitish rhizines from the lower cortex: *Cortex* 20–40 $\mu$  thick, the lower cortex being similar, both giving rise to cilia and rhizines of the same structure: *Algal layer* discontinuous, algal cells 7–16 $\mu$  diam.



*Apothecia* sessile rarely raised up on a thickening of the thallus, constricted at the base, up to 5 mm. diam. at first concave becoming convex at maturity: *Disk* nugget-bronze-yellow to orange-rufous: *Margin* slightly elevated, naked, but occasionally with a few small fibrils on the lower surface: *Hypothecium* 20–40 ( $-80\mu$  in the centre) thick: *Hymenium* 60–90 ( $-100\mu$ ) tall including the yellow, heavily encrusted granular epithecium: *Paraphyses* simple or branched: *Asci* 50–60 $\mu$  x 12–18 $\mu$  clavate: *Ascospores* hyaline, polaribilocular, canal mostly present though tending to disappear at maturity, 12–16 $\mu$  x 7–9 $\mu$ .

#### SPECIMENS EXAMINED

VICTORIA—Emu Creek, Sunbury, *Rex Filson* 4837, 20.5.1963 (MEL22653): Barmah State Forest, *Rex Filson* 4889, 10.6.1963 (MEL22652): Reilly's Creek Gorge, Brisbane Ranges, *Rex Filson* 4938, 29.6.1963 (MEL22651): Blackwood, *Rex Filson* 5172, 1.9.1963 (MEL22650): 1 mile north of Anthony's Cutting, Great Western Highway, *Rex Filson* 7170, 29.4.1965 (MEL9388): Jackson's Creek, Sydenham, *Robert F. Steel* 60, 2.11.1965 (MEL15702): Hill to the north of South Peak, Wilsons Promontory, *Rex Filson* 8213, 31.1.1966 (MEL14333): Suggan Buggan, *Rex Filson* 8310, 7.3.1966 (MEL15671): McKillop's Bridge, on the Snowy River, 18 miles east of Wulgulmerang, *Rex Filson* 8327, (MEL15670): Near the mouth of Werribee Gorge, 6 miles west of Bacchus Marsh, *John R. Brownlie*, 2.7.1967 (MEL22421).

NEW SOUTH WALES—Norwood, Sydney, *F. R. M. Wilson* (MEL7394): Beaudesert Hills, Guntawang, *A. G. Hamilton*, 20.8.1885 (NSW.L724 & L725): East Maitland Reserve *W. W. Watts*: Jenolan Caves, *F. R. M. Wilson*, Sept. 1897 (MEL7396): Parramatta, *Woolfs* (MEL7398): Murray River, *Charles French*, (MEL7424): Penshurst, *E. Cheel*, May 1900 (NSW.L693): Kingsgrove Road, Penshurst, *E. Cheel*, July 1900 (NSW.L746): Centennial Park, *E. Cheel*, July 1900 (NSW.L684): Centennial Park, *E. Cheel*, 28.7.1900 (NSW.L685): Tempe near Sydney, collector unknown 14, 19.9.1900 (BRI058755): Mosman, *Allen*, 5.8.1901 (NSW.L690): Young, *W. W. Watts*, 8.8.1904 (NSW.L740 & L743): Concord, *M. Flockton*, Aug. 1906 (NSW.L737 & L738): Hurstville, *E. Cheel*, Aug. 1906 (NSW.L739): Bowen Park, Orange, *W. Blakley*, Oct. 1906 (NSW.L745): Barren Jack, *Mrs. E. Cheel*, July 1909 (NSW.L749): Riverstone, *A. A. Hamilton*, 2.8.1909 (NSW.L750): Uriarra Crossing, Murrumbidgee River, ACT, *N. T. Burbidge*, 24.10.1947 (CANB93936): Jerilderie to Narrandera road, 19 miles SW. of Narrandera, *Rex Filson* 5424, (MEL10175): Narrandera to West Wyalong road, 19 miles north of Grong Grong, *Rex Filson* 5434, 13.10.1963 (MEL22654): Mt. Stromlo, *G. C. Bratt* 1019, 19.1.1964 (MEL18289): Black Mountain, A.C.T., *H. S. McKee* 11531, 11.7.1964 (CANB140427): Ardglen Gap, Liverpool Range, 5 miles north of Murrurundi, *Rex Filson* 7574, 28.10.1965 (MEL17334): Narrabri to Coonabarabran road, 1 mile north of Coonabarabran, *Rex Filson* 7832, 3.11.1965 (MEL17331): Summit of Bluff Mountain, Warrumbungles, *Rex Filson* 7868, 4.11.1965 (MEL14107): Nuada Rocks, Warrumbungles, *Rex Filson* 7873, 4.11.1965 (MEL15705): "The Creel" 5 miles west of Jindabyne on bank of Thredbo River, *Rex Filson* 7906, 2.12.1965 (MEL16566): North of Jacobs River Bridge, 12 miles south of Ingebyra, *Rex Filson* 7965, 3.12.1965 (MEL17332): 15 miles south of Narrandera, approx. midway between Narrandera and Boree Creek, *Helen I. Aston*, 16.9.1966 (MEL18301): Warrumbungle Ranges, *H. Alan Morrison*, 19.9.1966 (MEL18259): Mount Galore, 9 miles north-east of Lockhart, *J. H. Willis*, 27.8.1967 (MEL26381).

TASMANIA—Van Diemensland, *Charles Stuart*, (MEL7424): Coles Bay, East coast, *G. C. Bratt* 1892, 30.1.1965 (MEL9345): Western side of Killiecrankie Bay, Flinders Island, Furneaux Group, Bass Strait, *John Whinray*, 14.5.1966 (MEL16565): Cape Deslac, *G. C. Bratt* 2463, 17.7.1965 (MEL18275): Kingston, near Hobart, *G. C. Bratt* 2962, 12.12.1965 (MEL18278).

SOUTH AUSTRALIA—East Payneham, ca. 6 km north-east of Adelaide  
*J. G. O. Tepper* 28.1.1893 (AD); Wilpena Pound, Flinders Range, *Roy G. Gray*,  
31.8.1952 (MEL7452); Yourambulla Peak, Flinders Range, *N. N. Donner* 1341,  
4.5.1965 (MEL16553); Mount Lofty Range, ca. 37 km north-east Adelaide,  
*N. N. Donner* 1323, 5.6.1965 (MEL16552).

WESTERN AUSTRALIA—Christmas Island, Recherche Archipelago, *J. H. Willis*,  
28.11.1950 (MEL7454).



Fig. 39. Distribution map for *Teloschistes sieberianus* (Laur.) Hillm.

***Teloschistes spinosus*** (Hook. f. & Tayl.) J. Murray in Trans. R. Soc.  
N.Z. 88 : 205 (1960).

*Parmelia spinosa* Hook. f. & Tayl. in Lond. J. Bot. 3: 644 (1844).

*Physcia parietina* var. *spinulosa* Krplhb. in Verh. zool.-bot. Ges. Wien  
18: 322, t.4 fig. 4 (1868).

*Physcia subexilis* Nyl. in Cromb. in J. Linn. Soc. (Bot.) 17: 396  
(1879).

*Teloschistes flavicans* var. *subexilis* (Nyl.) F. Wilson in Pap. Proc.  
R. Soc. Tasm. 1892-93: 176 (1893).

*Xanthoria parietina* var. *spinulosa* (Krplhb.) Müll. Arg. in Bull. Herb.  
Boissier 2, append. 1: 40 (1894).

*Xanthoria spinulosa* (Krplhb.) Hillm. in Annls mycol. 18: 10 (1920).

*Teloschistes exilis* var. *subexilis* (Nyl.) Hillm. in Hedwigia 69: 336  
(1930).

*Thallus* usually composed of flat radiately appressed to ascending lobes up to 3 cm. diam. sometimes clustered into small cushions: *Lobes* small 0.3–0.8 mm. wide and up to 200 $\mu$  thick, brass to nugget-bronze-yellow, beset with fine fibrils on the upper surfaces, rhizines on the lower surface simple or branched, margins of the lobes granular sorediose or erumpent also beset with fine fibrils: *Cortex* 25–40 $\mu$  thick, uppermost cells encrusted with yellowish crystals, lower cortex up to 60 $\mu$  in places: *Algal layer* discontinuous, up to 60 $\mu$  thick, occasionally a second layer forms above the lower cortex, this layer when present, up to 30 $\mu$  thick: *Medulla* loosely woven.

*Apothecia* sessile, semi-immersed amongst the crowded filaments of the thallus, up to 4 mm. diam. concave at first becoming flat to slightly convex: *Disk* orange-rufous: *Margin* crenulate, persistent, slightly elevated, concolorous with the thallus: *Hypothecium*  $80\mu$  in the centre: *Hymenium* up to  $90\mu$  tall, epithecium thick up to  $20\mu$ : *Asci* approx.  $55\mu \times 16\mu$ : *Ascospores* hyaline polaribilocular, canal mostly present  $12-16\mu \times 8-9\mu$ : *Pycnidia* spherical in concolorous to slightly darker warts.

#### SPECIMENS EXAMINED

VICTORIA—Wilsons Promontory, *Ferd. Mueller*, May 1853 (MEL7427): Mount Arapiles, *F. M. Reader*, 24.8.1896 (MEL7407): Head of Middle Creek, Bogong High Plains, *J. H. Willis*, 17.1.1947 (MEL7458): Mount Arapiles, *A. C. Beauglehole* 1216, (MEL11298): Plateau near Wilkinson Lodge, Bogong High Plains, *Rex Filson* 4807, 11.5.1963 (MEL22636): Hollow Mountain, Victoria Range, *Rex Filson* 5282, 15.9.1963 (MEL22638): Mount Korong, 8 miles ESE. Wedderburn, *Rex Filson* 6588, 31.10.1964 (MEL22644): Melville Caves Park, 7 miles north of Rheola, *Rex Filson* 6628, 1.11.1964 (MEL22637): North end of Mount Vereker Range, Wilsons Promontory, *J. R. Brownlie*, 13.11.1966 (MEL18247): Summit of Mount Oberon, Wilsons Promontory, *J. H. Willis*, 14.1.1967 (MEL22401).

TASMANIA—Cat Island, Furneaux Group, Bass Strait, *John Warham*, Feb. 1958 (MEL7465): East Risdon near Hobart, *G. C. Bratt* 407, 4.8.1963 (MEL9351): Hill to the south of Killiecrankie Bay, Flinders Island, Furneaux Group, Bass Strait, *Rex Filson* 7075, 16.4.1965 (MEL9363): Great Dog Island, Furneaux Group, Bass Strait, *John Whinray*, 16.4.1965 (MEL16561): Cape Deslacs, *G. C. Bratt* 2460, 17.7.1965 (MEL18277): Bowen Park near Hobart, *G. C. Bratt* 2872, 27.11.1965 (MEL18281): Risdon Brock near Hobart, *G. C. Bratt* 2883, 27.11.1965 (MEL18276): Tin Kettle Island, Furneaux Group, Bass Strait, *John Whinray*, 2.4.1966 (MEL16033): Eastern end of Great Dog Island, Furneaux Group, Bass Strait, *John Whinray*, 27.4.1966 (MEL16036): Little Dog Island, Furneaux Group, Bass Strait, *John Whinray*, 28.4.1966 (MEL16029): Eastern side of small granite hill on south western side of Killiecrankie Bay, Flinders Island, Furneaux Group, Bass Strait, *John Whinray*, 28.5.1966 (MEL16564): Killiecrankie Bay, Flinders Island, Furneaux Group, Bass Strait, *John Whinray*, 29.7.1966 (MEL17358): West Sister Island, Furneaux Group, Bass Strait, *John Whinray*, 14.8.1966 (MEL18294): Flinders Island, Furneaux Group, Bass Strait, *John Whinray*, 30.8.1966 (MEL18267):

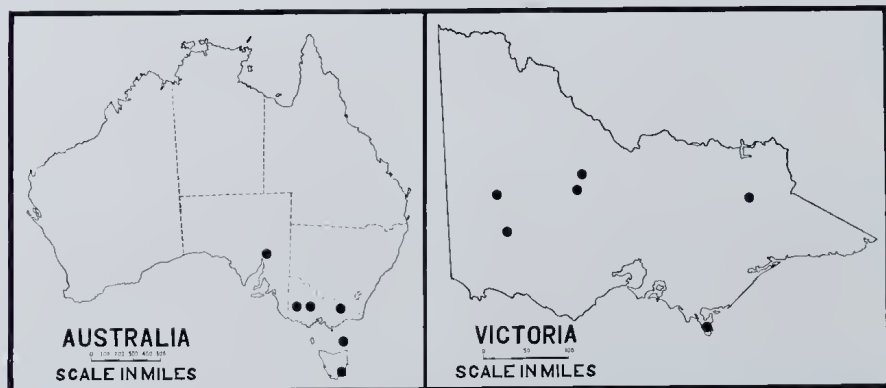


Fig. 40. Distribution map for *Teloschistes spinosus* (Hook. f. & Tayl.) J. Murray.

**Teloschistes spinosus** (Hook. f. & Tayl.) J. Murray forma **subteres**  
R. Filson forma nov.

A forma typica speciei differt laciniis majoribus manifeste subteretibus.

*Thallus* composed of subterete dichotomously branched filaments, 0.1–0.4 mm. thick, brass to nugget-bronze-yellow, margins, lower and upper cortex beset with concolorous fibrils: *Pycnidia* in small concolorous to slightly darker warts.

SPECIMENS EXAMINED

VICTORIA—Wilsons Promontory, *Ferd. Mueller*, May 1853 (MEL7426): Sealers Cove, Wilsons Promontory, *Rex Filson* 5384, 29.9.1963 (MEL26129): Adam and Eve Rocks, Wilsons Promontory, *John R. Brownlie*, 1.1.1967 (MEL22416): Tongue Point, western coast of Wilsons Promontory, *J. H. Willis*, 13.1.1967 (MEL22402).

TASMANIA—Killiecrankie Bay, Flinders Island, Furneaux Group, Bass Strait, *John Whinray*, 16.4.1965 (MEL9365): Western end of Little Green Island, Furneaux Group, Bass Strait, *John Whinray*, 27.3.1966 (MEL16038): Table Cape near Wynyard, NW. coast, *J. H. Willis*, 6.1.1967 (MEL22399).

NEW SOUTH WALES—Rylstone to Mount Corricudgerie road, 21 miles E. Rylstone, *Rex Filson* 6500, 14.10.1963 TYPE (MEL16606).

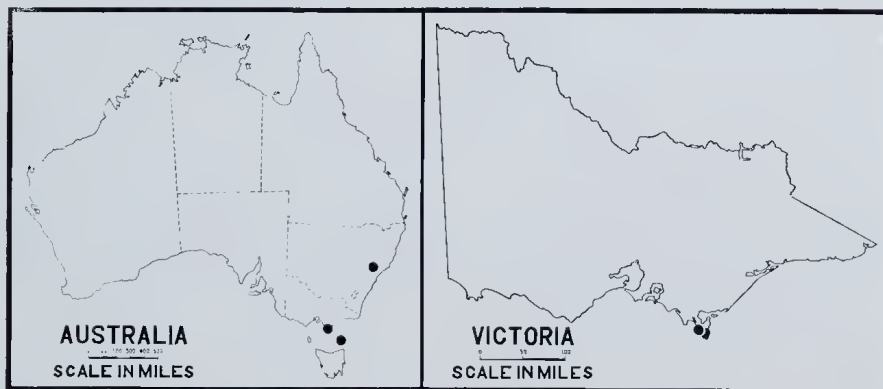


Fig. 41. Distribution map for *Teloschistes spinosus* forma *subteres* R. Filson.

**Teloschistes velifer** F. Wilson in Victorian Nat. 6 : 69 (1889).

*Teloschistes chrysophthalmus* var. *fornicatus* Müll. Arg. in Bull. Herb. Boissier 4: 89 (1896).

*Xanthoria spinulosa* (Krpilb.) Hillm. Ann. Mycolog. p. 10 (1920).

*Thallus* subfruticose, individual plants from 3–10 mm. diam. and up to 1 cm. high, at times single and at others tightly clustered together completely encircling small branchlets: *Lobes* in the juvenile state form small rosettes, stellate radiate 0.2–0.8 mm. wide, when mature are ascending up to 5 mm. wide, slightly hooded at the apex, open underneath; the open part thus exposed, ecorticate, sorediose; varying in colour from lime-yellow to nugget-bronze-yellow: *Cortex* 30–40 $\mu$  thick,



outermost  $10\mu$  heavily encrusted with yellowish crystals, lower cortex  $40\text{--}60\mu$  thick hyaline: *Algal layer* in scattered colonies, cells  $7\text{--}16\mu$  diam.: *Medulla* loosely woven of hyphae  $3\mu$  diam.

*Apothecia* up to 3 mm. diam. concave at first becoming convex at maturity: *Disk* orange-rufous: *Margin* slightly elevated, crenulate, concolorous with the thallus: *Hypothecium*  $30\mu$  thick in the centre: *Hymenium*  $60\mu$  tall including the granular epithecium: *Paraphyses* simple or branched: *Asci*  $50\text{--}60\mu \times 12\text{--}15\mu$  clavate: *Ascospores* hyaline, polaribilocular, canal mostly present  $12\text{--}16\mu \times 6\text{--}8$  ( $-10$ )  $\mu$ .

#### SPECIMENS EXAMINED

VICTORIA—Yarra River bank near Heidelberg, *F. M. Reader*, 8.6.1884 (MEL7386): Ovens River, *Walter*, ca. 1867 (MEL7419): Maffra, *F. R. M. Wilson*, Mar. 1889 TYPE (MEL7384): Kew, *R. A. Bastow*, 3.11.1900 (MEL7412): Fernshaw, *R. A. Bastow*, 11.11.1900 (MEL7387): Bealiba, *C. Jenkins*, 20.11.1901 (MEL7388): Tooradin, *H. Reeves*, July 1939 (MEL7383): Cobberas Mountains, *J. H. Willis*, Feb. 1946 (MEL7494): Upper Gellibrand River Falls, *A. C. Beaglehole* 3191, 11.2.1952 (MEL11295): Hills east of Trafalgar, *Rex Filson* 3985, 29.10.1961 (MEL22646): Coliban River Falls, *Rex Filson* 5072, 10.8.1963 (MEL22647): Blackwood, *Marie Allender*, 18.8.1963 (MEL22648): Bright, *G. C. Bratt* 1657, 15.1.1964 (MEL9359): Binginwarri, 11 miles east of Alberton, *John Williams*, Aug. 1964 (MEL9122): Coopers Creek, *G. C. Bratt* 1657, 10.10.1964 (MEL9360):  $7\frac{1}{2}$  miles NNE. Yea, *Rex Filson* 6645, 8.11.1964 (MEL22649): Mushroom Rocks on the south side of Mount Erica, *Rex Filson* 7001, 1.2.1965 (MEL22645): Ettrick, near the bridge at the Bessibelle turnoff, 4 miles from Tyrendarra, *Bruce Fuhrer*, 13.6.1965 (MEL16041): In local garden, Acheron, *G. A. Chrichton*, 30.8.1965 (MEL11223): Holmes Plain above Shaws Creek and below Kelly's Hut, Benison Plains, *Robert F. Steel* 55, 27.12.1965 (MEL15699): Junction on Towonga-Harrietteville road, 4 miles east of Bright, *Rex Filson* 8054, 18.1.1966 (MEL17324): The peak on the northern end of Mount Wombargo, *Rex Filson* 8258, 5.3.1966 (MEL15668): Mount Stradbroke, north-west of Suggan Buggan, *Rex Filson* 8306, 6.3.1966 (MEL17329): Muddy Creek Gorge at Kooroocheang, near Smeaton, *J. H. Willis*, 12.4.1966 (MEL15667): Upper Buffalo River, *Robert F. Steel* 61, 21.5.1966 (MEL22423).

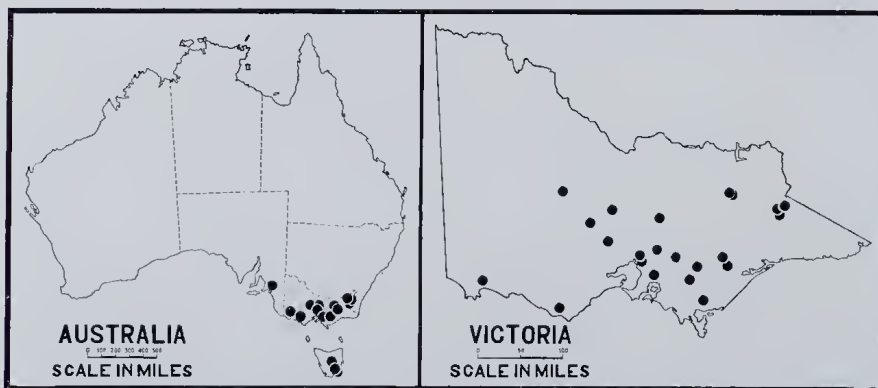


Fig. 42. Distribution map for *Teloschistes velifer* F. Wilson.



TASMANIA—Constitution Hill near Oatlands, *G. C. Bratt* 3105, 29.1.1966 (MEL18284): Jordan River near Brighton, *G. C. Bratt* 3262, 6.2.1966 (MEL18273): 16 miles from Campbelltown on the road to Cressy, *J. A. Cashin*, 11.6.1966 (MEL22476): Sorell-Nugent road, *G. C. Bratt* 4107, 12.7.1967 (MEL22478).

NEW SOUTH WALES—Coolman Plain in the northern extremity of the Kosciusko State Park, *J. H. Willis*, 21.2.1961 (MEL7480): 9 miles east of Cooma, on the Numerella road, *Rex Filson* 7877, 2.12.1965 (MEL16569): "The Creel" 5 miles west of Jindabyne on the banks of the Thredbo River, *Rex Filson* 7904, 2.12.1965 (MEL16605): Kybean, 14 miles north-east of Nimmitabel, *John Williams*, 13.10.1966 (MEL18263).

SOUTH AUSTRALIA—Murray Bridge, ca. 70 km south-east Adelaide, collector unknown 13.11.1881 (AD).

***Teloschistes velifer* F. Wilson forma *nodulosa* (J. Murray) R. Filson**  
comb. & stat. nov.

*Teloschistes fasciculatus* Hillm. var. *nodulosa* J. Murray in Trans.  
R. Soc. N.Z. 88: 206 (1960).

*Thallus* in pulvinate clusters up to 4 cm. diam.: *Lobes* ascending 0.5–2 mm. broad and up to 7 mm. long, margins extremely sorediose, rhizines reduced to a few stunted threads.

#### SPECIMENS EXAMINED

VICTORIA—Cobberas Mountains, *Ferd. Mueller*, Jan-Feb. 1854 (MEL7429): Right-hand spur above Middle Creek, below the Scout Hut, Bogong High Plains, *Coryl I. Skewes*, 19.1.1952 (MEL7488): Rocky Valley, Bogong High Plains, *Coryl I. Skewes*, 22.1.1952 (MEL9494): Mount Buller, *J. Ross Garnet*, Jan. 1956 (MEL7422): Behind Wilkinson Memorial Lodge, Bogong High Plains, *Rex Filson* 6381, 27.4.1964 (MEL14167): Holmes Plain, near Kelly's Hut, *Robert F. Steel* 58, 27.12.1965 (MEL15701): Mount Cope, Bogong High Plains, *Rex Filson* 8104, 19.1.1966 (MEL17325): Buckety Plain, Bogong High Plains, *Rex Filson* 8180, 21.1.1966 (MEL17330): Twin Knobs, The Razorback, NE. Alps, *J. H. Willis*, 13.2.1966 (MEL15672): The Peak at the northern end of Mount Wombargo, *Rex Filson* 8258a, 5.3.1966 (MEL15669): The Sentinels, Mount Wellington area, *J. H. Willis*, 12.3.1966 (MEL15666): Spion Kopje



Fig. 43. Distribution map for *Teloschistes velifer* forma *nodulosa*.  
(J. Murray) R. Filson

Ridge,  $\frac{1}{2}$  mile west of Mount Nelse North, Bogong High Plains, *Rex Filson* 9533, 23.1.1967 (MEL19697): Peak due east from Pretty Valley Pond, Bogong High Plains, *Rex Filson* 9559, 24.1.1967 (MEL22412): Mount Jim, Bogong High Plains, *Rex Filson* 9629, 27.1.1967 (MEL22413): Mount McKay, Bogong High Plains, *Rex Filson* 9650, 28.1.1967 (MEL22515): Mount Loch, *Rex Filson* 9818, 16.2.1967 (MEL22403): 50 feet below the summit of Mount Feathertop on the eastern side, in the vicinity of Hellfire Gully, *Rex Filson* 9858, 17.2.1967 (MEL22407): Summit of the Cobberas Mountains, *Rex Filson* 10017, 21.2.1967 (MEL22406).

TASMANIA—Sentinel Island, Furneaux Group, Bass Strait, *John Whinray*, 27.8.1966 (MEL18266).

NEW SOUTH WALES—Vicinity of the Tin Mine, Kosciusko Region, *Selby Alley*, Dec. 1963 (MEL22398): Mount Kosciusko, *G. C. Bratt* 1017, 16.1.1964 (MEL9340): Charlottes Pass on the Kosciusko road, *Rex Filson* 7923, 2.12.1965 (MEL14292): Vicinity of the Ramshead Range, Kosciusko High Plains, *John Williams*, 15.10.1966 (MEL18258): The Pilot, Great Dividing Range, 6 miles north of the Victorian Border, *Rex Filson* 9954, 20.2.1967 (MEL22409).

***Teloschistes xanthoroides*** J. Murray in Trans. R. Soc. N.Z. 88: 209 (1960).

*Thallus* in small irregular clumps up to 1.5 cm. diam. and 5 mm. high, the central portion nearly obscured by crowded apothecia: *Lobes* small 0.5–1 mm. long and 0.15–1 mm. wide, french-grey to wax-yellow, fibrils absent from the margins and upper surface, scattered simple rhizines on the lower surface: *Cortex* 30–40 $\mu$  thick, the uppermost part encrusted with yellow crystals: *Algal layer* discontinuous up to 120 $\mu$  thick with cells scattered through the medulla, cells up to 16 $\mu$  diam.: *Medulla* loosely compacted of hyphae 4 $\mu$  diam.

*Apothecia* shortly pedicellate, 1–2 mm. diam., concave: *Disk* brass: *Margin* elevated, entire to crenulate, grey to yellowish-grey, naked or sometimes extended in places to connect it to the margin of the adjoining apothecium: *Hypothecium* hyaline up to 30 $\mu$  thick in the centre:



Fig. 44. Distribution map for *Teloschistes xanthoroides*. J. Murray.

*Hymenium* 80 $\mu$  tall: *Paraphyses* 4 $\mu$  diam., mainly simple, occasionally the slightly expanded apical cell furcate: *Asci* clavate 45 x 20 $\mu$ : *Ascospores* hyaline, polaribilocular, canal disappearing on maturity, 14–17 $\mu$  x 9–12 $\mu$ .

#### SPECIMENS EXAMINED

NEW SOUTH WALES—Dorrigo National Park, on the eastern side of Dorrigo Mountain, 24 miles west of Bellingen, *Rex Filson* 7646, 29.10.1965 (MEL17333).

#### *Xanthoria ectanea* (Ach.) Räs. ex R. Filson comb. nov.

*Xanthoria ectanea* (Ach.) Räs. in An. Soc. cient. arg. Secc. S Fé 131: 103 (1941)—*Nomen nudum*.

*Parmelia parietina* var. *ectanea* Ach. Lichen. Univ. 464 (1810).

*Xanthoria parietina* var. *ectanea* (Ach.) Kickx. Flor. Cryptog. Flandres, 2: 228 (1867).

*Thallus* foliose up to 8 cm. diam.: *Lobes* more or less radiate, up to 2.5 mm. wide and 4–6 mm. long, ultimate lobes 1.0–1.75 mm. wide, mostly convex, smooth, the margins slightly raised then deflexed, lime-yellow to nugget-bronze-yellow: *Cortex* 30–40 (–80) $\mu$  thick, heavily encrusted with yellow crystals, sometimes only in the outer layers and then sometimes extending right through and into the algal layer, lower cortex 20–30 $\mu$  thick, similar in structure to the upper cortex: *Algal layer* continuous or discontinuous 40–80 (–100) $\mu$  thick of cells 6–16 $\mu$  diam.: *Medulla* loosely woven of hyphae 4 $\mu$  diam.

*Apothecia* clustered on the older portion of the thallus 0.6–2.25 mm. diam., concave, becoming convex occasionally hemispheric: *Disk* usually darker than the thallus ranging from yellow-ochre through orange to raw-sienna: *Margin* thin, concolorous with the thallus or a little darker, prominent, sometimes disappearing: *Hypothecium* 40–60 $\mu$  thick, hyaline: *Hymenium* 65–80 $\mu$  tall including the granular epithecium: *Paraphyses* simple, 4 $\mu$  diam., apical cell expanded to 6 $\mu$ : *Asci* 40 x 14 $\mu$ : *Ascospores* hyaline, polaribilocular, canal sometimes absent 14–16 (–20) $\mu$  x 6–8 $\mu$ : *Pycnidia* immersed in the thallus, spherical up to 160 $\mu$  diam.

#### SPECIMENS EXAMINED

VICTORIA—East Gippsland, *Charles Walter*, 1869 (MEL7430): Loutitt Bay, *Luehmann*, ca. 1893 (MEL7433): Black Rock, *R. A. Bastow*, 26.12.1899 (MEL7448): Heidelberg, *R. A. Bastow*, 29.12.1899 (MEL7447): Frankston, *R. A. Bastow*, 3.3.1900 (MEL7417): Kew, *R. A. Bastow*, 3.3.1900 (MEL7442): Mortlake, *Murdoch*, Sept. 1900 (MEL7443): Williamstown, *R. A. Bastow*, 23.12.1900 (MEL7445): Queenscliff, *R. A. Bastow*, 4.1.1902 (MEL7444): Portsea, *Yerdally*, 9.1.1902 (MEL7446): Creswick, *J. H. Willis*, 29.5.1935 (MEL7470): Thurla near Mildura, *J. H. Willis*, Sept. 1940 (MEL7489): Williamstown, *P. Bibby*, Sept. 1942 (MEL7441): Mud Island, *J. H. Willis*, 30.11.1945 (MEL7481): Beeac, *A. C. Beaglehole* 3243, 8.2.1952 (MEL10181): Two miles west of Pirron Yallock, *A. C. Beaglehole* 3158, (MEL10182): "Rock Ravine", *Drik Drik*, *A. C. Beaglehole* 3264, 24.2.1952 (MEL11293): Anglesea, *E. Packe*, 24.1.1953 (MEL7496): Emu Creek near Sunbury, *Rex Filson* 4838, 20.5.1963 (MEL22435): Coliban River Falls, 4 miles SW. Redesdale,

*Rex Filson* 5073, 10.8.1963 (MEL22437): Oberon Bay, Wilsons Promontory, *Rex Filson* 5375, 29.9.1963 (MEL22436): Mount Cottrell, 11 miles from Werribee, *Mary Todd*, 1964 (MEL7615): Point Danger, Portland, *Rex Filson* 7307, 23.5.1965 (MEL10162): 21 miles north of Linga on the road to Sunset Tank, *Rex Filson* 7365, 7.8.1965 (MEL11289): Lara, 9 miles NNE. Geelong, *R. C. Weeks*, Jan. 1966 (MEL18288): Hill to the north of South Peak, Wilsons Promontory, *Rex Filson* 8214, 31.1.1966 (MEL14332): Cape Liptrap, *H. Alan Morrison*, 5.4.1967 (MEL22420): Fish Creek to Yanakie road 1.9 miles north of Yanakie, *H. Alan Morrison*, 7.4.1967 (MEL22419):  $\frac{1}{2}$  mile east from Seal Rocks, Phillip Island, *John Williams*, 15.7.1967 (MEL22434).

TASMANIA—Van Diemens Land, *Ch. Stuart* 1020, 1850 (MEL7440): Billerina, *R. A. Bastow*, 25.7.1887 (MEL7450): King Island, *Charles French Jr.*, Nov. 1887 (MEL7439): Deal Island, Kent Group, Bass Strait, *Colin A. Garreau*, 7.7.1957 (MEL7457): Cat Island, Bass Strait, *John Warham*, Feb. 1958 (MEL7461): Cape Deslacs, near South Arm, *G. C. Bratt* 126, 5.5.1963 (MEL9350): Taroona Beach near Hobart, *Rex Filson* 6674, 4.1.1965 (MEL18618): The Nut, Stanley, *J. H. Willis*, 27.1.1965 (MEL7586): Palana, Flinders Island, Furneaux Group, Bass Strait, *Rex Filson* 7076, 16.4.1965 (MEL9364): Killiecrankie Bay, Flinders Island, Furneaux Group, Bass Strait, *Rex Filson* 7047, 16.4.1965 (MEL9366): Bridgewater near Hobart, *G. C. Bratt* 2870, 27.11.1965 (MEL18279): Risdon Brook, near Hobart, *G. C. Bratt* 2884, 27.11.1965 (MEL18287): Kingston near Hobart, *G. C. Bratt* 2961, 12.12.1965 (MEL18282): Seal Rocks road, ca.  $1\frac{1}{2}$  miles west of Surprise Bay, SW. sector of King Island, *J. H. Willis*, 5.3.1966 (MEL15700): Roden Island, Furneaux Group, Bass Strait, *John Whinray*, 7.3.1966 (MEL16030): Western end of Little Green Island, Furneaux Group, Bass Strait, *John Whinray*, 27.3.1966 (MEL16037): Eastern end of Great Dog Island, Furneaux Group, Bass Strait, *John Whinray*, 27.4.1966 (MEL16032): Little Dog Island, Furneaux Group, Bass Strait, *John Whinray*, 28.4.1966 (MEL16028): Small Islet off Killiecrankie Bay, Flinders Island, Bass Strait, *John Whinray*, 19.5.1966 (MEL17360): Killiecrankie Bay, Flinders Island, Furneaux Group, Bass Strait, *John Whinray*, 29.7.1966 (MEL17359): Prime Seal Point, Hummock Island, Furneaux Group, Bass Strait, *John Whinray*, 1.8.1966 (MEL17349): 200 yards SE. of the Mamana turnoff at Emita, Flinders Island, Furneaux Group, Bass Strait, *John Whinray*, 3.8.1966 (MEL17356): Sentinel Island, Furneaux Group, Bass Strait, *John Whinray*, 6.8.1966 (MEL17353): West Sister Island, Furneaux Group, Bass Strait, *John Whinray*, 14.8.1966 (MEL18292): The Nut, Stanley, *J. H. Willis*, 3.1.1967 (MEL22400).

NEW SOUTH WALES—Parramatta, *Woolfs*, ca. 1900 (MEL7432): Rocks at Morna Point, 3 miles south of Nelsons Bay, *Rex Filson* 4767, 20.4.1963 (MEL10156): Montagu Island, *J. Cassell*, July 1964 (MEL7473): 9 miles east of Cooma on the Numeralla road, *Rex Filson* 7881, 2.12.1965 (MEL16570).

SOUTH AUSTRALIA—Colona Station near Fowlers Bay, *J. H. Willis*, 27.8.1947 (MEL7435): Nullarbor Station, Nullarbor Region, *D. S. Kemsley*, 6.1.1952 (MEL7469): Koonalda Station, Nullarbor Region, *D. S. Kemsley*, 9.1.1952 (MEL7462): Near Knowles Cave, 25 miles NW. Nullarbor HS., *D. S. Kemsley*, 9.1.1952 (MEL7492): Middle River, North Coast of Kangaroo Island, *S. J. Edmonds*, ca. 1952 (MEL7490): Koomoolooka Cave, Nullarbor Region, *D. S. Kemsley*, 13.1.1952 (MEL7466): Shed Tanks, 26 miles west of Koonalda, *J. H. Willis*, 5.9.1963 (MEL7471): Near Nundroo, Nullarbor Region, *R. T. M. Pescott*, 17.10.1965 (MEL16770): Kings Beach Cliffs near Victor Harbor, *R. W. Rogers*, 31.1.1966 (MEL16196): Stuart Highway 24 miles NW. of Port Augusta, *J. H. Willis*, 3.8.1966 (MEL17314): Adelaide road 11 miles south from Port Wakefield, *J. H. Willis*, 3.8.1966 (MEL17316).

WESTERN AUSTRALIA—New Holland, *Preiss*, ca. 1839 (MEL9147): Frasers Range, *R. Helms*, 20.9.1891 (MEL7436): Boxer Island, Recherche Archipelago, *J. H. Willis*, 9.11.1950 (MEL7476): Garden Island, off Perth, *G. G. Smith*, ca. 1960 (MEL7483): 8 miles east of Mundrabilla, Eyre Highway, *R. T. M. Pescott*, 16.9.1965 (MEL11325): Dundas Rocks, south of Norseman, *A. C. Beaglehole*



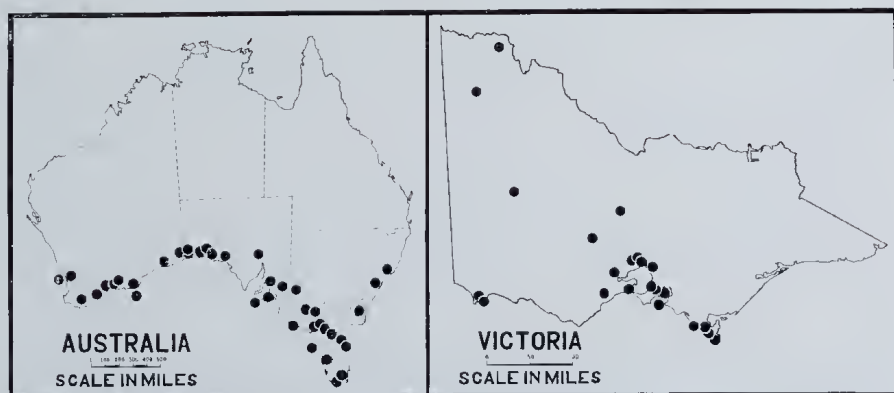


Fig. 45. Distribution map for *Xanthoria ectanea* (Act.) Räs. ex R. Filson

14799, 18.9.1965 (MEL14329): 11 miles west of Mundrabilla, 370 miles east of Norseman, *A. C. Beauglehole* 14855, 23.9.1965 (MEL14335): Cape le Grand, 32 km south-east of Esperance, *N. N. Donner*, 18.10.1965 (MEL16197): Road from Norseman to Esperance 64 km SSW of Norseman, *N. N. Donner*, 19.10.1965 (MEL16554): Saddle between Nancys Peak and the Devils Slide, Porongorup Range, *Rex Filson* 9051, 29.9.1966 (MEL18248): Bremer Bay, *Rex Filson* 9088, 1.10.1966 (MEL18272): Culham Inlet, 6 miles west of Hopetoun, *Rex Filson* 9206, 5.10.1966 (MEL18257): Mount Le Grand, 30 miles SE. of Esperance, *Rex Filson* 9251, 7.10.1966 (MEL18256): Thistle Bay, Cape Le Grand, 37 miles east of Esperance, *Rex Filson* 9275, 8.10.1966 (MEL 18244): 33 miles north of Eucla Motel on the road to Reid, *Alex. S. George* 8499, 14.10.1966 (MEL18359): Twilight Cove, Great Australian Bight, *Alex. S. George* 8556b, 16.10.1966 (MEL18352).

***Xanthoria parietina* (L.) Beltr. Lichen. Bassan. 102 (1858).**

*Lichen parietinus* L. Spec. Plant. 1143 (1753).

*Parmelia parietina* (L.) Ach. Method. Lichen. 213 (1803).

*Physcia parietina* (L.) DeNot. in Giorn. Bot. Ital. 2: 197 (1847).

*Teloschistes parietina* (L.) Norm. in Nyt Mag. Naturvid. 7: 229 (1853).

*Thallus* foliose up to 10 cm. diam., but usually smaller: *Lobes* 0.5–5 mm. wide, radiate, concave, rugulose, the margins slightly raised and flexuose, wax-yellow to nugget-bronze-yellow in exposed positions, french-grey to mustard in shaded: *Lower surface* white to pinkish, yellowing towards the margins of the lobes: *Cortex* 30–50 $\mu$  thick, uneven, lower cortex similar: *Algal layer* up to 60 $\mu$  thick of cells 7–16 $\mu$  diam.: *Medulla* of loosely woven hyphae 3 $\mu$  diam.

*Apothecia* clustered on the older portions of the thallus, slightly constricted at the base, up to 3 mm. diam., irregularly circular, concave, becoming convex: *Disk* usually darker than the thallus: *Margin* thin, naked, sometimes crenulate, concolorous with the thallus: *Hypothecium* 20–40 $\mu$  thick: *Hymenium* up to 80 $\mu$  tall including the granular epithecium: *Paraphyses* simple, branched, apical cell slightly thickened:



*Asci* 40–65 (–75)  $\mu$  x 13–16  $\mu$ : *Ascospores* hyaline, polaribilocular, canal mostly present (9–) 12–15  $\mu$  x (5–) 7–10  $\mu$ : *Pycnidia* spherical, up to 170  $\mu$  diam.

#### SPECIMENS EXAMINED

VICTORIA—Mordialloc, R. A. Bastow, 3.3.1900 (MEL7411): Upper Gellibrand River Falls, A. C. Beaulehole 3190, 11.2.1952 (MEL11296): Seaholme, Port Phillip Bay, T. B. Muir 788, 16.8.1959 (MEL7474): Creswick, J. H. Willis, 13.1.1963 (MEL9121): Rye, Mornington Peninsula, Rex Filson 4011, 27.11.1961 (MEL26157): Cape Patterson, Rex Filson 5191, 7.9.1963 (MEL26160): Lady Julia Percy Island, Geoff Carr, Dec. 1963: 7½ miles NNE. Yea, Rex Filson 6646, 8.11.1964 (MEL26161): Jeffrey turnoff on the Caveat road, ca. 10 miles NW. of Alexandra, George Crichton, 9.11.1964 (MEL10155): Woodend to Trentham road, 4 miles west of Woodend, Rex Filson 7045, 28.3.1965 (MEL26158): Korweinguboorra Springs, near Spargo Creek between Daylesford and Ballarat, Marie Allender, 16.5.1965 (MEL16603): Portland, Rex Filson 7269, 22.5.1965 (MEL10163): Triodia Hill, Lower Glenelg River, Rex Filson 7289, 22.5.1965 (MEL10160): Jones's Cliffs, Lower Gleneg River, Rex Filson 7281, 22.5.1965 (MEL10159).

TASMANIA—Sorell-Nugent road, G. C. Bratt 1401, 26.7.1964 (MEL9343): Constitution Hill near Oatlands, G. C. Bratt, 29.1.1966 (MEL18283): Tin Kettle Island, Furneaux Group, Bass Strait, John Whinray, 2.4.1966 (MEL16039): Prime Seal Point, Hummock Island, Furneaux Group, Bass Strait, John Whinray, 1.8.1966 (MEL17350).

SOUTH AUSTRALIA—Houghton, Mt. Lofty Ranges, R. L. Specht, ca. 1950 (MEL7464): Adelaide Hills near Inglewood, J. G. Tracey, Oct. 1952 (MEL7434): Naracoorte, D. Hunt, June–July 1962 (MEL16211): Hahndorf, Adelaide Hills, Rex Filson 4917, 18.6.1963 (MEL26159): River Torrens Gorge ca. 20 km NE. of Adelaide, N. N. Donner 1307, 13.3.1965 (MEL9117): Princes Highway, 7 miles east of Murray Bridge, R. T. M. Pescott, 29.6.1966 (MEL17335).

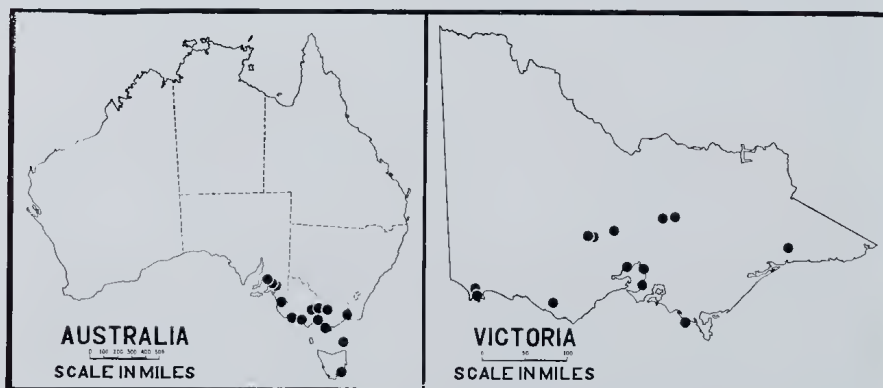


Fig. 46. Distribution map for *Xanthoria parietina* (L.) Beltr.

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PLATE 3

*Teloschistes chrysophthalmus* (L.) Th. Fries

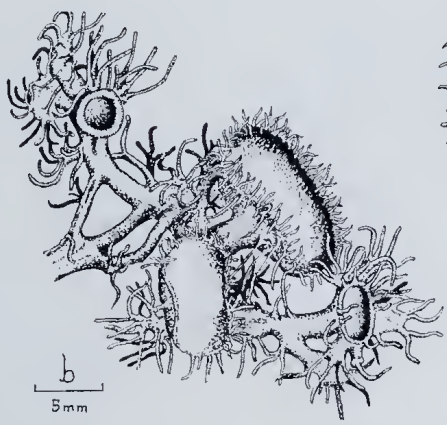
- a. Typical narrow-lobed thallus growing on a small branch
- b. Enlargement of portion of the thallus showing apothecia in various stages of development
- c. Enlargement of portion of the thallus showing underside of apothecia
- d. Section through portion of apothecium
- e. Two stages in development of ascus
- f. Mature spores
- g. Section through portion of thallus



PLATE 3



a  
1cm



b  
5mm



c  
5mm



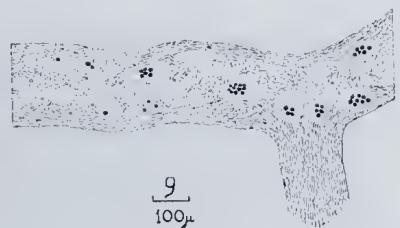
d  
100μ



e  
5μ



f  
5μ



g  
100μ

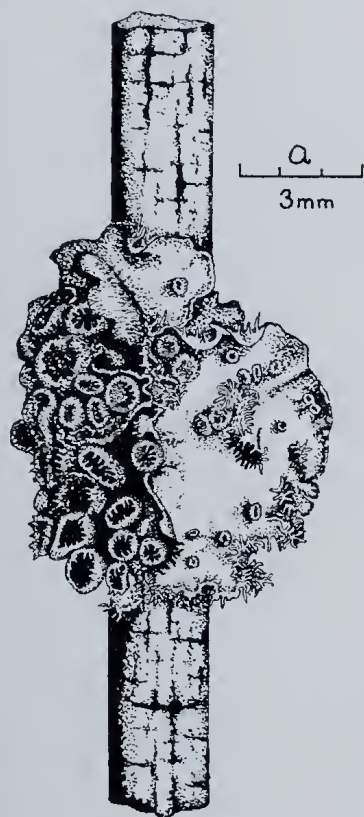
1965

PLATE 4

*Teloschistes chrysophthalmus* (L.) Th. Fries

- a. Typical broad-lobed thallus growing on a small branch
- b. Enlargement of apothecium
- c. Section through portion of thallus showing structure of upper and lower cortex
- d. Section through portion of apothecium

PLATE 4



1965.

c  
50 $\mu$

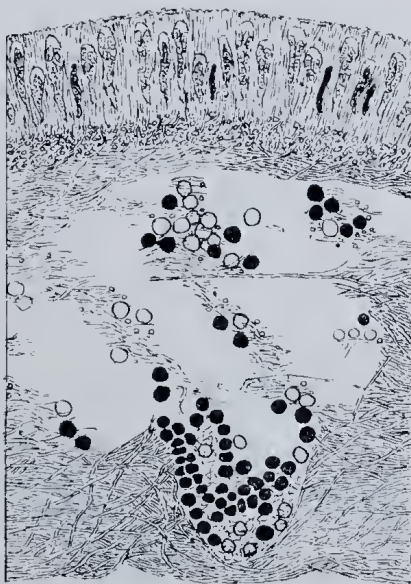
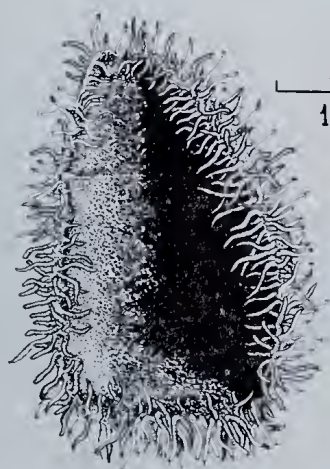
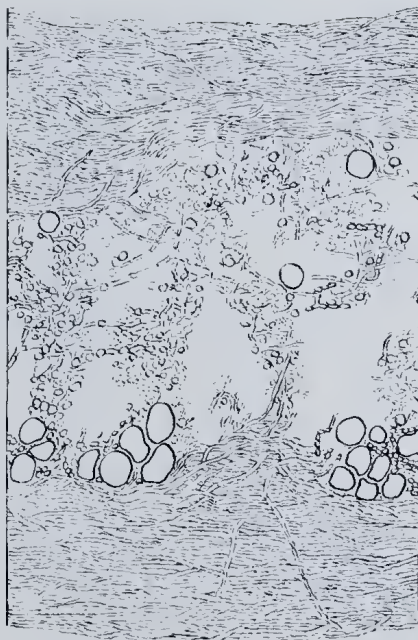
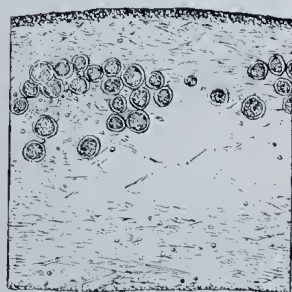
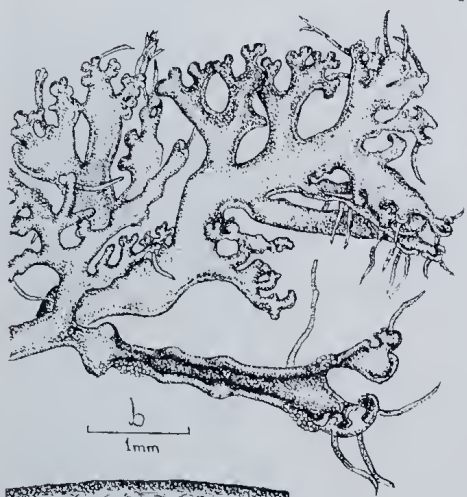


PLATE 5

*Teloschistes fasciculatus* Hillm.

- a. Typical thallus growing amongst foliage of *Podocarpus lawrencei* Hook. f.
- b. Enlargement of portion of thallus
- c. Enlargement of thallus lobe showing soredia on margins
- d. Section through portion of thallus
- e. Enlargement of section through thallus

PLATE 5



© 1967



PLATE 6

*Teloschistes flavicans* (Sw.) Norm.

- a. Typical thallus growing over branches of *Rhodamnia argentea*
- b. Enlargement of thallus lobe showing soralia
- c. Enlargement of thallus lobe showing apothecia
- d. Section through apothecium
- e. A branched paraphysis from hymenium
- f. Two stages in development of ascus
- g. Two mature spores
- h. Longitudinal section through portion of thallus
- i. Cross section through portion of thallus

# PLATE 6

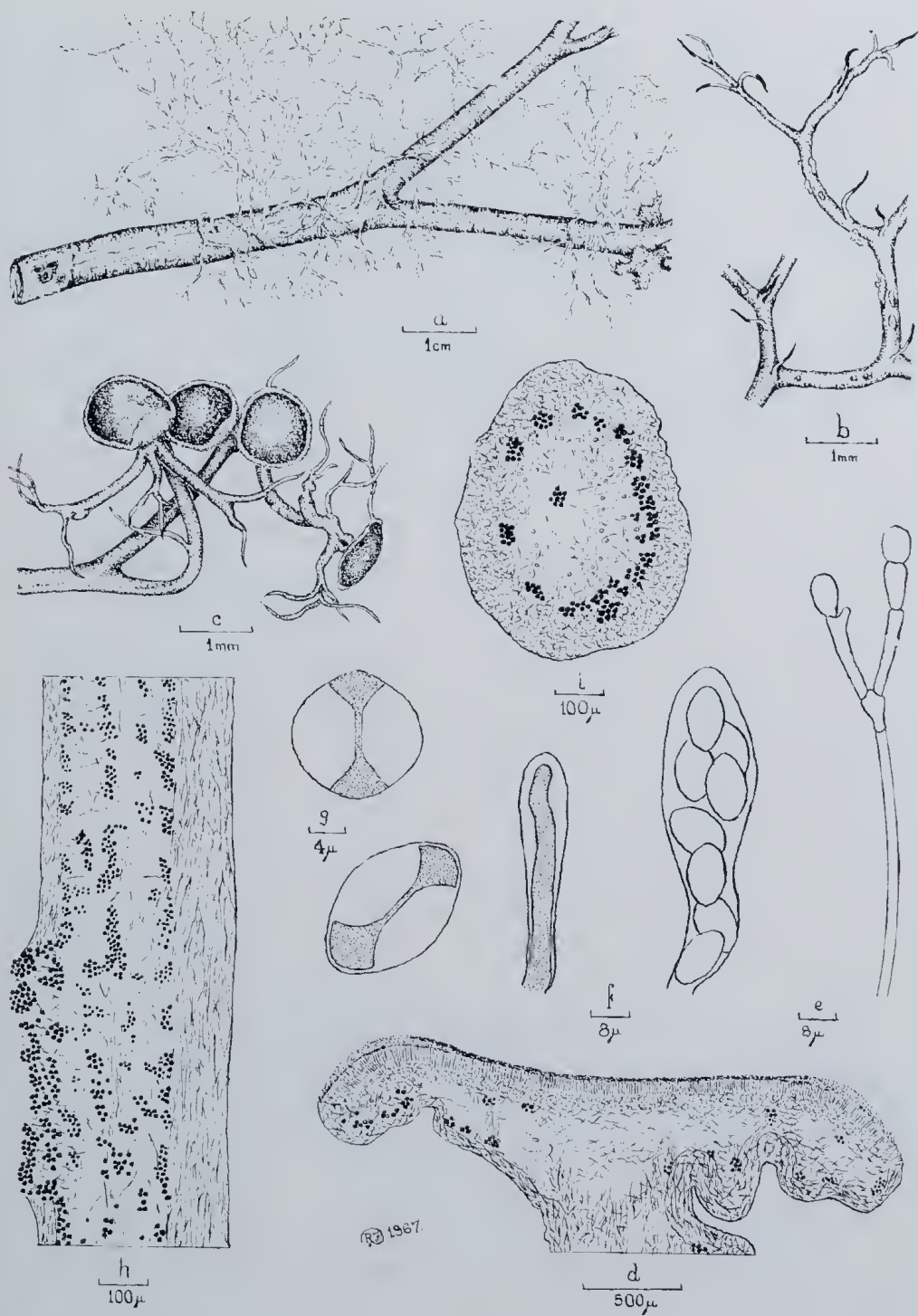
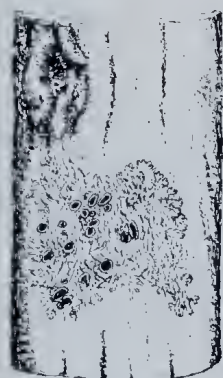


PLATE 7

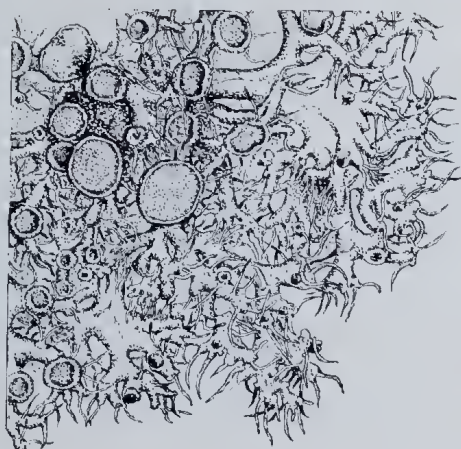
*Teloschistes sieberianus* (Laur.) Hillm.

- a. Typical thallus growing on a branch of small tree
- b. Enlargement of portion of thallus
- c. Enlargement of apothecia showing naked margins and cilia  
which is occasionally found on the lower apothecial cortex
- d. Enlargement of thallus lobe showing pycnidia
- e. Section of portion of thallus lobe showing pycnidia
- f. Section through apothecium
- g. Enlargement of section of apothecium
- h. Three stages in development of ascus

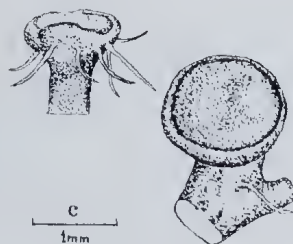
# PLATE 7



a  
1 cm



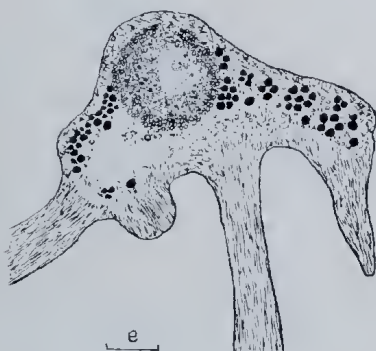
b  
1 mm



c  
1 mm

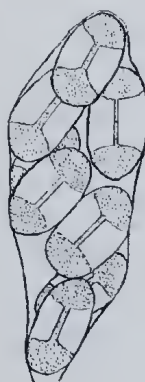


d  
1 mm

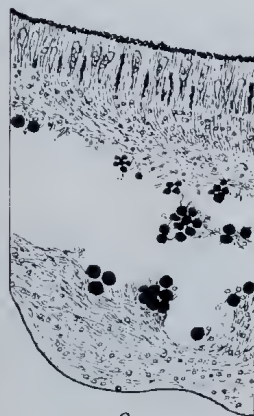


e  
100 μ

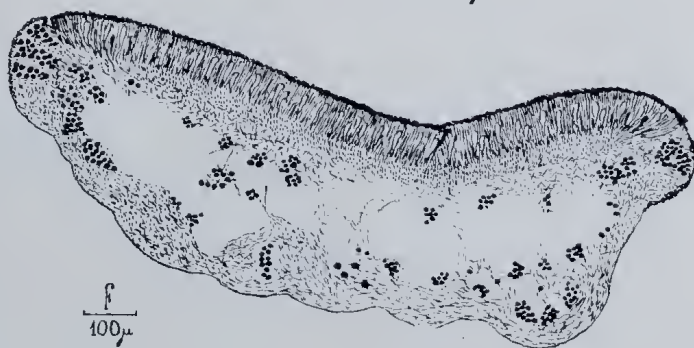
(R2) 1965



h  
10 μ



g  
100 μ



f  
100 μ

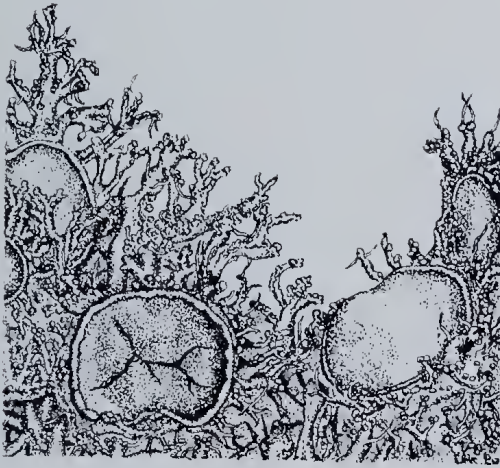
PLATE 8

*Teloschistes spinosus* (Hook. f. & Tayl.) J. Murray

- a. Typical thallus growing over rocks on Cat Island, Furneaux Group, Bass Strait
- b. Enlargement of thallus lobe showing pycnidia and granular soredia
- c. Section through portion of thallus lobe showing pycnidia
- d. Enlargement of apothecium
- e. Enlargement of section through apothecium
- f. Two stages in development of ascus
- g. Mature spore
- h. Enlargement of longitudinal section through thallus lobe
- i. Enlargement of cross section of thallus lobe (excluding marginal cilium)



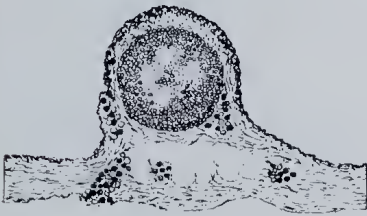
PLATE 8



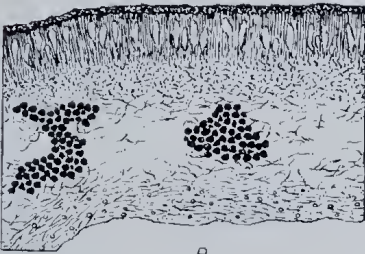
a  
1mm



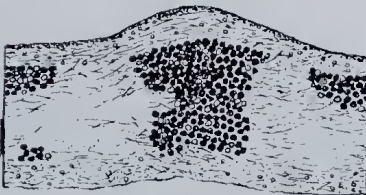
b  
500μ



c  
100μ



e  
100μ



h  
100μ



i  
100μ



d  
500μ



j  
4μ



k  
8μ



1967

PLATE 9

*Teloschistes spinosus* forma *subteres* R. Filson

- a. Typical fine intricately branched thallus growing over rocks
- b. Enlargement of thallus lobes

PLATE 9



a  
1cm

© 1967



b  
1mm

PLATE 10

*Teloschistes velifer* Wilson

- a. Typical thallus growing over *Hymenanthera gentata*
- b. Thallus lobe showing development of apothecium
- c. Thallus lobe showing mature apothecium
- d. Undersurface of thallus lobe showing open-hooded ends with soredia
- e. Section through end of thallus lobe showing soredia on undersurface under open-hooded-ends
- f. Section through an apothecium
- g. Paraphyses from hymenium
- h. Stages in development of ascus
- i. Mature spores

PLATE 10

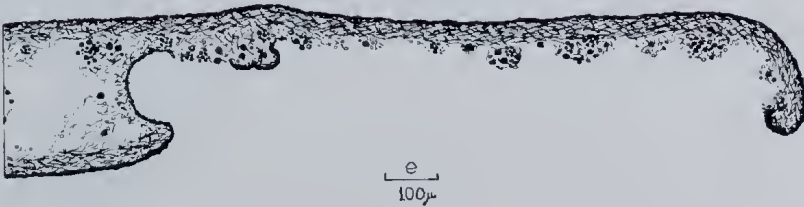
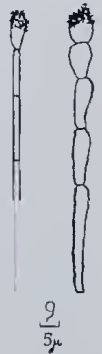
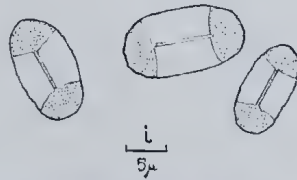
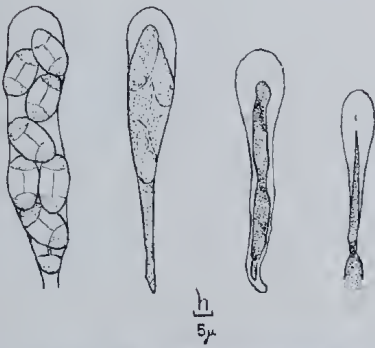
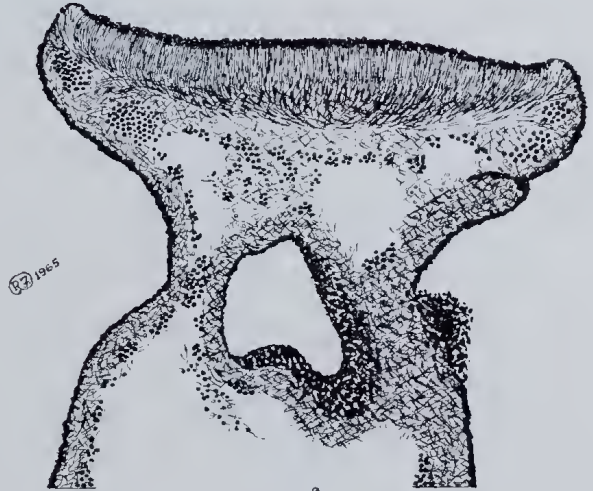
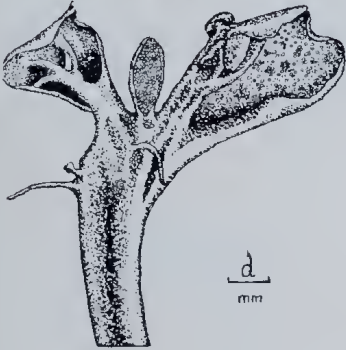
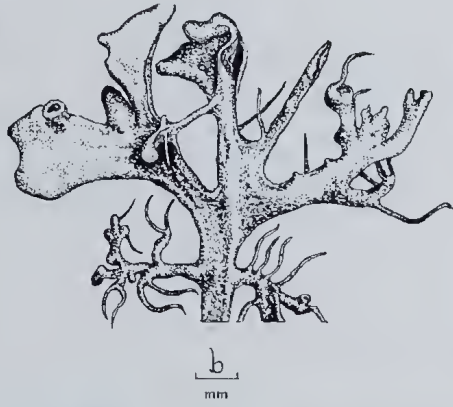
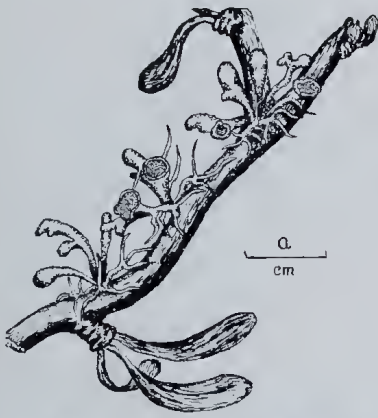




PLATE 11

*Teloschistes velifer* forma *nodulosa* (J. Murray) R. Filson

- a. Typical thallus growing in rock crevices
- b. Enlargement of contorted thallus lobes showing soredia

PLATE 11

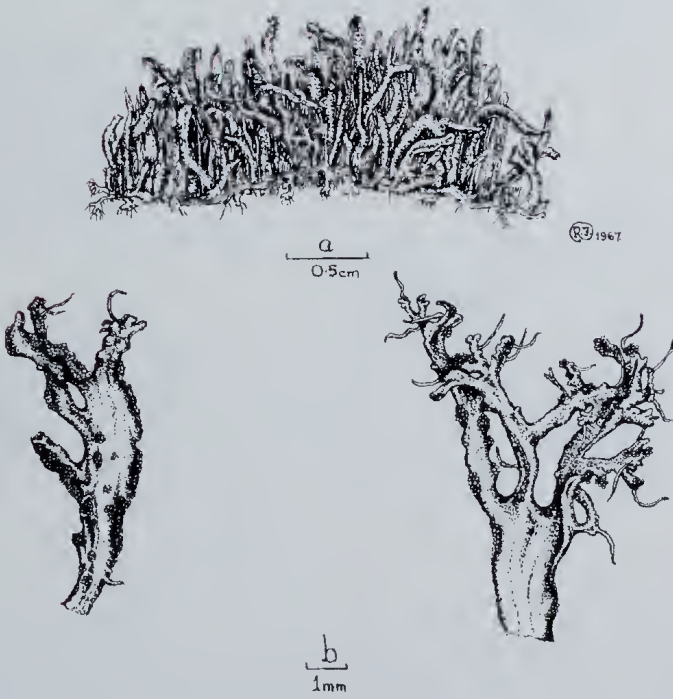


PLATE 12

*Teloschistes xanthoroides* J. Murray

- a. Typical thallus growing on small branches
- b. Enlargement of thallus lobe showing apothecia
- c. Section through apothecium
- d. Showing development of ascus
- e. Mature spores
- f. Section through portion of thallus

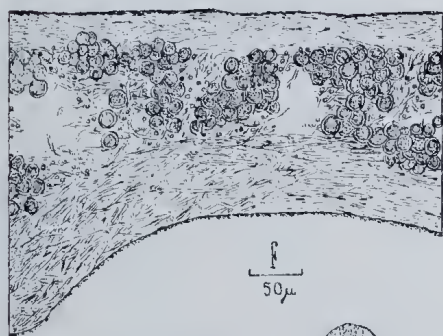
PLATE 12



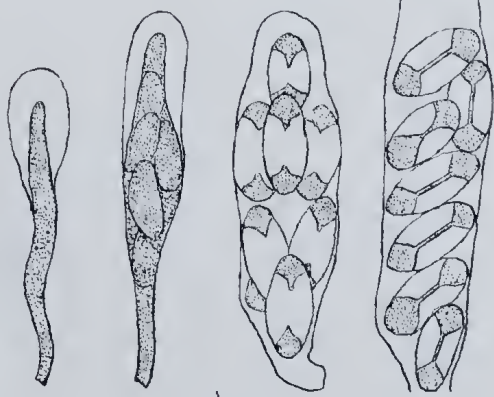
a  
5mm



b  
1mm



c  
50μ



d  
8μ



e  
4μ



f  
100μ

1967

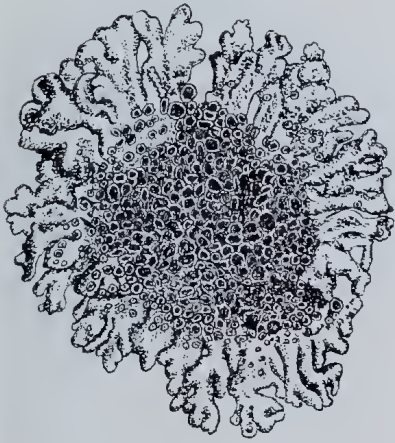
PLATE 13

*Xanthoria ectanea* (Ach.) Räs. ex R. Filson

- a. Typical thallus growing over rocks
- b. Portion of thallus lobe showing developing apothecium
- c. Enlargement of thallus lobe showing mature apothecium
- d. Section through portion of apothecium
- e. Showing development of ascus
- f. A branched and unbranched paraphysis showing granules in epithecium
- g. Mature spores



PLATE 13

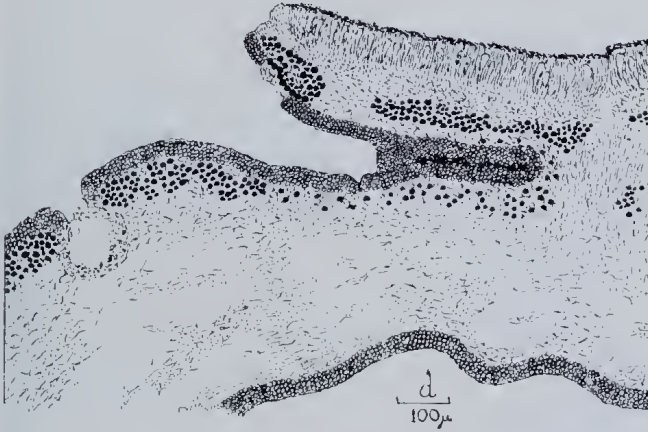


a  
cm



1955

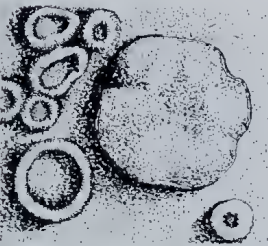
b  
mm



d  
100 $\mu$



g  
10 $\mu$



c  
cm



e  
10 $\mu$



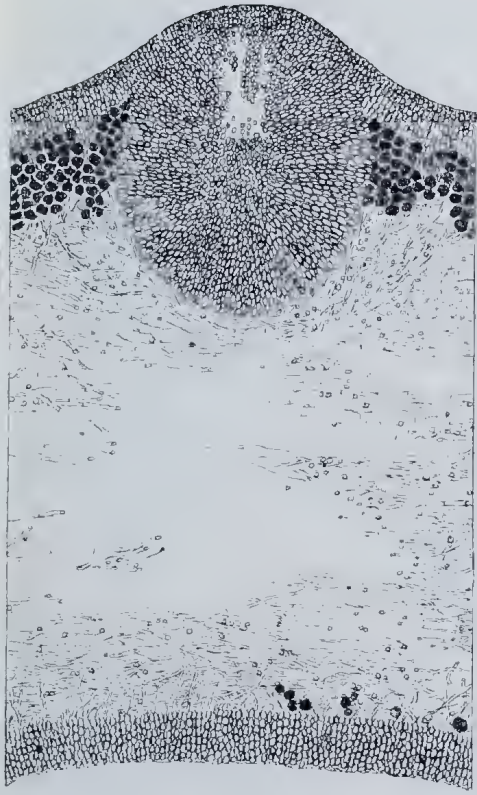
f  
10 $\mu$

PLATE 14

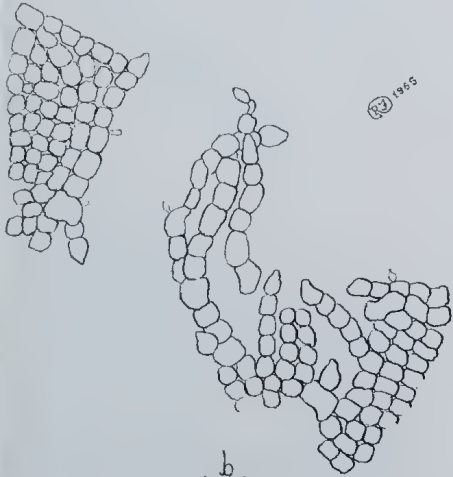
*Xanthoria ectanea* (Ach.) Räs. ex R. Filson

- a. Section through end of thallus lobe showing pycnidia
- b. Enlargement of hyphae from pycnidia
- c. Enlargement of section of thallus showing structure of lower and upper cortex
- d. Enlargement of section of apothecium

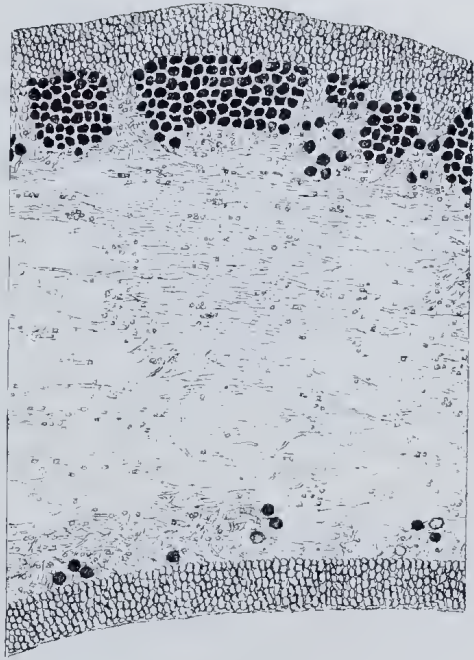
PLATE 14



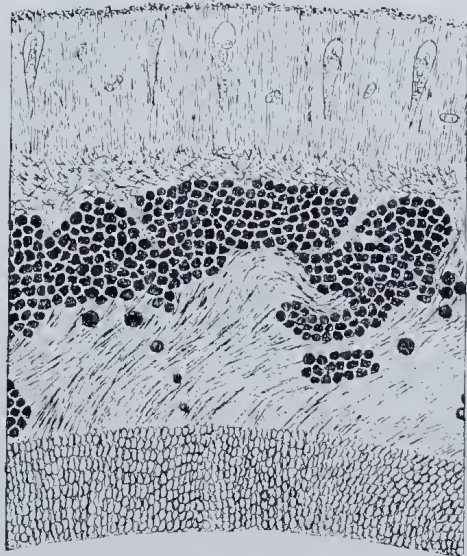
a  
100 $\mu$



b  
10 $\mu$



c  
100 $\mu$



d  
100 $\mu$

PLATE 15

*Xanthoria parietina* (L.) Beltr.

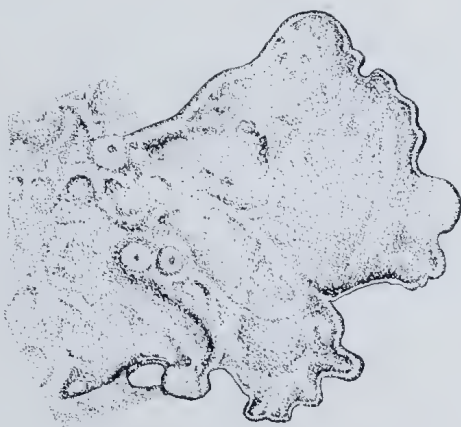
- a. Portion of thallus growing on tree trunk
- b. Enlargement of thallus lobe
- c. Section through portion of thallus lobe
- d. Enlargement of apothecium
- e. Section through portion of apothecium
- f. Two stages in development of ascus
- g. Mature spores
- h. Branched paraphysis from hymenium



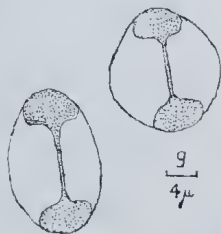
PLATE 15



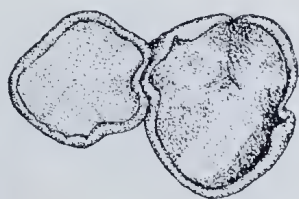
a  
0.5 cm



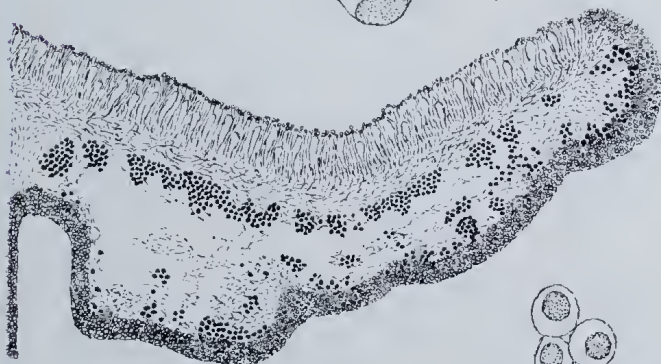
b  
1 mm



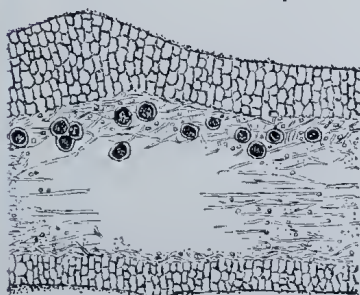
g  
4  $\mu$



d  
1 mm



e  
100  $\mu$



c  
50  $\mu$



h  
4  $\mu$

1967



i  
4  $\mu$



j  
4  $\mu$



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